PSYCHOSOCIAL PREDICTORS OF DIETARY BEHAVIOUR

Anne Helen Baker

ABSTRACT

For over two decades, epidemiological research has provided increasingly stronger evidence for a link between fruit and vegetable consumption and, cancer and heart disease. This has led health experts to recommend that people consume at least 5 servings of fruit and vegetables a day. In the UK, as in many European countries, the average consumption is approximately half the recommended level. Research has also shown that there are low levels of nutritional knowledge within the community, which might be one explanation for these low levels.

The present studies examine the associations between cognitions and behaviour for intake of fruit and vegetables in two different populations, and then test the efficacy of a tailored intervention for changing eating behaviour, knowledge and attitudes in two randomised controlled studies.

Two large studies were carried out in different samples of the population. The first study took place in a cancer screening setting with an older adult sample (n=1054), and showed that knowledge and attitudes were independent predictors of dietary behaviour. Data from the baseline survey were used to create a brief, personalised, tailored intervention designed to increase knowledge, improve attitudes and thereby modify behaviour. Results from the 6-week follow-up showed that the intervention was successful in improving nutritional knowledge, changing attitudes to fruit and increasing fruit and vegetable intake. Increases in intake were correlated both with increases in nutritional knowledge and positive change to attitudes.

The second study was planned as a replication and extension of the first, with some improvements in measures and a more representative sample. It took place in a dental clinic setting (n=1846). Knowledge and attitudes were again shown to be independent predictors of fruit and vegetable intake, and variations in knowledge accounted for some of the demographic variations in intake. Subsequently a 3-group design was then used to test the effectiveness of the tailored intervention, comparing it this time to a general intervention and an untreated control group. The tailored intervention group produced significant changes in behaviour and knowledge compared to both the general intervention and control group, while the general intervention produced only significant increases to nutritional knowledge.

The results suggest that tailored interventions can be a successful tool to use for changing knowledge and attitudes, and is more effective than a standard leaflet for everybody. Therefore it is important to consider the practicalities of using tailoring in the design of dietary interventions especially for improving fruit and vegetable intake which have previously been difficult to adjust.

The two studies were limited by self-report measures of intake, and future work needs to consider incorporating some kind of objective validation. Also while medical settings proved feasible for carrying out interventions, participants were not representative of the general population, so any extrapolation to the general population must be cautious. Future research might examine setting effects for efficacy as well as feasibility. The recent developments in information technology could be used to assist future intervention studies in producing tailored interventions for larger groups of people.

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Diet and disease

There is growing consensus that diet is central in prevention of both heart disease and cancer. Heart disease, strokes and cancer account for more than 66% of deaths in the United Kingdom (ONS, 2000). Doll and Peto (1981) in their study of the causes of cancer, estimate that between 20% and 70% of cancer mortality could be prevented by dietary changes. The World Cancer Research Fund (WCRF) (1997) carried out an extensive review of all published studies on diet and cancer. They concluded that stomach, oesophagus and colon cancer could be reduced by as much as 75% by dietary changes whilst lung, breast and mouth cancers could be reduced by as much as 33%, with dietary behaviour identified as most important to these cancers being fruit and vegetable consumption.

Fruit and vegetables and disease

The proposed link between plant foods and cancer is not new. Shaw (1907) believed that eating more food from vegetable origins could reduce the risk of cancer, whilst Stock (1933) identified low intake of fruit and vegetables as risk factors for cancer in his British case control study, which looked at cancer incidence and dietary patterns. Fruit and vegetables are thought to have protective effects because of the antioxidant nutrients they contain. The mechanism most widely regarded is that antioxidants halt the damage caused by free radical and oxidative events, which are central to cancer development. Antioxidants are defined as 'substances capable of protecting cell membranes and macromolecules including lipids, DNA and RNA from the damage caused by oxidative reactions', whilst free radicals are defined as 'highly reactive, short lived molecules which are thought to be involved in the process of carcinogenesis by reacting with cell constituents, particularly with DNA' (WCRF, 1997). Fruit and vegetables are high in antioxidant nutrients which are thought to control the damage done by free radicals. The antioxidant nutrients are vitamin A in the form of beta carotene, vitamin C, vitamin E and selenium, all of which are high in fruit and vegetables. Fruit and vegetables are also thought to be protective against heart disease (Diplock and Rogers (1998). Again, the association between antioxidants and free radicals is implicated, with free radicals thought to impair low density lipoprotein cholesterol that protects us against heart disease.

Most of the evidence on the protective effects of fruit and vegetables derives from cohort studies. Incidence of disease is related retrospectively to data on food intake. The largest review of studies looking at the link between fruit and vegetables and cancer was conducted by Block, Patterson and Subar (1992). They reviewed over 200 studies and found evidence for a protective effect of fruit and vegetables against a variety of cancers in 82% of the studies reviewed. The review concluded that there would be a major public health benefits to substantially increasing both fruit and vegetable intake. The strongest associations emerged for epithelial cancers (Steinmetz & Potter, 1991) and stomach and lung cancers (Van Poppel, 1996). Ness & Powles (1997) conducted a systematic review of the literature on the association between cardiovascular disease and fruit and vegetable intake. The types of studies included were international, case control, cohort and prospective studies carried out between 1966 and 1995. The results were found to be consistent with a strong protective effect of fruit and vegetables on stroke and a weaker, though significant effect on heart disease. However more than half of these studies did not measure actual fruit and vegetable intake but used nutrients as a proxy for intake. Their review of 46 studies did not investigate any trials which looked at only fruit and vegetable intake, the majority of studies including fruit and vegetables as one component of overall dietary behaviour. Both of these reviews were conducted in an attempt to substantiate the growing evidence for a link between fruit and vegetables and disease. The focus of literature has been on the nutrients rather than foods. More studies are needed to look at the impact of actual dietary change of fruit and vegetables on cardiovascular disease and cancer.

Law & Morris (1998) attempted to quantify the relationship between fruit and vegetable intake and the incidence of ischaemic heart disease (IHD) by conducting a meta analysis of cohort studies. Altogether they reviewed 20 studies, 12 of which measured actual consumption and 8 of which measured serum or plasma concentration of vitamins. They found that the risk of IHD was 15% lower at the highest centile than the lowest centile of fruit and vegetable consumption. The authors conclude that fourfold increases in fruit and twofold increases in vegetable intake would reduce the risk of heart disease by more than a seventh. This review concludes that there is a significant, but modest effect of fruit and vegetables on IHD. As yet no intervention studies have actually quantified the relationship between increased intake and heart disease, so cohort studies are an important stepping stone in understanding the possible impact of additional consumption.

There are several methodological problems in the studies reviewed which may need to be addressed before further conclusions can be drawn. The majority of studies are either large international studies or cohort studies. Whilst these types of study usually have large sample sizes, conclusions can not be drawn on an individual level. There is an obvious need to have more prospective studies with longer follow up times, to ascertain the long term implication of increased fruit and vegetable intake. Prospective studies ensure that possible confounding variables can be taken into consideration and also offer the opportunity to intervene on dietary behaviour in the process. Intervention studies aimed at increasing fruit and vegetable intake, where the long term effects on cancer and heart disease could be measured, would give an indication of how changes to intake can reduce incidence of disease. However, practical limitations of cost, time and sampling may be some of the reasons why such studies have not been carried out.

Dietary recommendations

There have been recommendations to increase intake of fruit and vegetables in association with disease prevention since the mid 1960's in Sweden (Blix and Wretlimd, 1965), the early 1970's in the US (American Health Foundation, 1972), and since 1976 in the UK (Royal College of Physicians of London/British Cardiac Society). However it was not until 1990 that the World Health Organisation recommended that an intake of at least 400 grammes of fruit and vegetables a day, equivalent to 5 servings. Since that time this has been taken up as the standard recommended minimum level of intake.

World-wide consumption levels

In most Western countries, intake of fruit and vegetables is substantially below the recommended level. Average daily servings range from approximately 3 servings in the Netherlands (Hulshof, Lowik, Kistemaker, Hermus, ten Hoor and Ockhuizen, 1993), through 3-4 servings among different states in America (Serdula, Coates, Byers, Simoes, Mokdad and Subar, 1995) to as much as 7-8 a day in southern European countries (Agudo, Amioano, Barcos, Barricarte, Beguiristain, Chirlaque, Dorronsoro, Gonzalez, Lasheras, Martinez, Navarro, Pera, Quiros, Rodriguez and Tormo, 1999). Serdula et al (1995) investigated intake in 23,699 adults across America using a food frequency questionnaire and found average consumption to be 3.3 servings a day for men and 3.7 servings a day for women, with only 20% of adults eating the recommended 5 servings a day. Krebs-Smith, Cook, Subar, Cleveland and Friday (1995a) in another US study looked at intake of fruit and vegetables in 8,181 adults and found that the average daily intake of fruit and vegetables was 4.3 servings. In this study 32% of respondents were consuming 5 servings a day but only 12% were consuming at least 2 servings of fruit and 3 servings of vegetables per day. This level of intake is higher than the other wide-scale studies conducted in the US, which may be an artefact of measurement rather than sample. Furthermore in this study, 24 hour dietary recalls were used first, then participants completed a 48 hour food diary for the two subsequent days. This may have led both to increased intake and over-estimation of fruit and vegetables in the self measured food diary period. Although average intake levels are close to recommended levels, when the intake distributions are examined the majority of people do not reach target levels. It is apparent that the majority of people in the US are not consuming the recommended levels of fruit and vegetables daily.

Studies conducted in Mediterranean countries have shown higher intake than in most other countries. Agudo et al (1999) investigated fruit and vegetable intake in 15,635 men and 25,813 women across Spain. These results indicate that Spanish men consume approximately 7.8 servings a day while women consume 7.5 servings a day. More than 70% of participants were consuming at least 5 servings a day. Even though all participants in this study were healthy volunteers it is clear that Spaniards consume significantly more fruit and vegetable than other European countries and the United States.

Wardle, Steptoe, Bellisle, Davou, Reschke, Lappalainen and Fredrikson (1997) as part of the European Health and Behaviour Survey (Wardle and Steptoe, 1991) looked at healthy dietary practices among over 16,000 students from 21 European countries. They found that there was great variation in the eating patterns amongst different countries, but again, in Mediterranean countries more people ate fruit daily than in other European countries. For example 80% of women and 72% of men consumed fruit daily in Italy compared with only 41% of women and 27% of men in Scotland.

UK intake levels

The National Food Survey (1998) estimates consumption of fruit and vegetables to be around 270 grammes per person a day in the UK on the basis of purchasing figures for household expenditure in 5,973 households. These volunteer households kept a diary of food purchases for 7 days, which is given by the adult responsible for domestic food arrangement. Data from this survey suggests that there has been little change in either fruit or vegetable consumption in the past ten years. Actual consumption as measured with food diaries in the Nutritional Survey of British Adults (Gregory, Foster, Tyler and Wiseman, 1990) found that daily consumption was approximately 3.1 servings of fruit and vegetables in adults.

Two smaller surveys carried out in the UK using retrospective reports of fruit and vegetable intake found similarly low levels of intake in participants. Wardle, Parmenter and Waller (2000) using a self reported measure found average consumption levels to be 3.2 servings a day in 1,040 adults contacted through their general practice. Another study of adults by Anderson, Hunt, Ford and Finnegan (1994) examined intake in 1710 adults (aged 39-60 years) in the West of Scotland, traditionally one of the worst areas from the point of view of fruit and vegetable intake. They found that intake levels were approximately 1.4 servings of fruit and vegetable combined a day which is less than a third of the recommended amount. These smaller studies support the findings on intake using different types of measures (e.g. self reported intake and food frequency).

Demographic differences

Many of the studies looking at fruit and vegetable intake have identified demographic differences. Several studies show that men consume fewer servings of fruit and vegetables than women (Smith & Smith, 1994; Thompson, Margetts, Speller and McVay, 1999; Wardle, Parmenter and Waller, 2000). Lower SES groups tend to eat less fruit and vegetables than those from higher SES groups (Smith & Smith, 1994; Krebs-Smith et al, 1995a; Thompson et al, 1999; Wardle et al, 2000) and those with less education consume less than more educated people (Smith & Smith, 1994; Serdula et al, 1995; Krebs-Smith et al, 1995a; Thompson et al, 1999; Wardle et al, 2000). Thompson et al (1999) analysed data from the 1993 Health and Lifestyle Survey and reported that men were 1.2 times more likely to be low consumers of fruit and vegetables than women. Wardle et al (2000) found that being female and better educated were significant predictors of higher fruit intake, while being female and higher social class were significant predictors of higher vegetable intake in a sample of GP patients.

Measurement of fruit and vegetables

There are several ways in which researchers have attempted to measure fruit and vegetable intake, including food diaries, 24 hour recalls, food frequency scales and estimates of daily intake.

Food diaries require individuals to record everything they have eaten within a certain time scale from which total fruit and vegetable intake can be extracted. While this offers a realistic measure of actual food consumed, these are difficult for participants to complete because of the time it takes and also the difficulty of remembering to record everything that is eaten. It is also likely to have an effect on normal dietary patterns if people are aware that they have to record their forthcoming dietary behaviour. Resnicow, Smith, Baranowski T, Baranowski J, Vaughan, and Davis (1998) used 7 day food diaries to track fruit and vegetable consumption in children as part of an intervention study. The results indicate that over three years there was a significant shift in the ranking of participants in the control group (receiving no intervention) which illustrates the fluctuations in measured intake levels. Limitations of the measurement might explain the differences in intake over the three years.

Twenty four-hour recall has been used in other studies. This requires individuals to remember everything they have eaten in the past 24 hours. The obvious limitation of this method is that some people may find it difficult to remember everything they have eaten within 24 hours. Also the day to day variation in intake limits the value of this, except in large studies. It is quite common in dietary studies to use 24 hour recalls alongside food frequency measures (Gortmaker, Cheung, Peterson, Chomitz, Cradle, Dart, Fox, Bullock, Sobol, Colditz, Field and Laird 1999).

An alternative widely used, method are food frequency scales. Participants have to select the frequency with which they have consumed the listed fruit and vegetables. The number of questions asked and the time period which is assessed are arbitrary. If too few food items are listed then this may lead to under reporting because the items do not cover the normal dietary intake of the individual, while if too many are listed this may lead to over reporting because the individual is unable to determine exact frequency over time. Completion of these questionnaires can also be time consuming due to the number of questions being asked. The number of questions asked vary from 6 (Serdula, Coates, Byers, Mokdad, Jewell, Chavez, Mares Perlman, Newcomb, Ritenbaugh and Treiber, 1993) specifically on fruit and vegetables to 141 (Steinmetz and Potter, 1993) on a variety of dietary factors, from which fruit and vegetable intake is subsequently calculated. The measures are limited by daily fluctuations in dietary behaviour but also by participant's ability to record dietary behaviour accurately. In studies where there are many different factors being assessed it is necessary to use briefer measures to cut down on time.

More recently single item measures have been used extensively to examine average daily intakes of fruit and vegetables. Participants are asked to self-report how many servings of fruit and vegetables they consume in either a day or a week. Single item measures are quick and easy to self-complete.

Smith-Warner, Elmer, Fosdick, Tharp and Randall (1997) compared three dietary assessments methods for measuring fruit and vegetable intake: diet records, food frequency questionnaires and brief food frequency questionnaires. Diet records were conducted for three consecutive days where participants had to record all foods, drinks and nutrient supplements they had consumed. The two food frequency measures consisted of a 153 item food frequency questionnaire with 57 items specific to fruit and vegetable consumption and the brief modules consisted of 6 questions. They found that there was good reliability for all three assessment methods over three months (i.e. the results were replicable), changes in measured intake with one measure was also associated with changes in intake of the other two measures. However, mean intake for the first two methods of measurement was 6.4 servings compared to 3.8 servings in the short frequency module. It is not clear whether potatoes were included in the measurement although they were one of the questions on the brief module measure. Potatoes are generally accepted to be part of an individual's starch intake not vegetable intake. Participants in this study were 201 patients at a private clinic who had been diagnosed with colorectal adenomas, therefore it is not known whether they had received prior information about intake levels as a results of their condition. However it does show that estimates of dietary intake depend on the method used for investigation

Marcus, Heimendinger, Wolfe, Rimer, Morra, Cox, Lang, Stengle, Van Herle, Wagner, Fairclough and Hamilton (1998) suggest that short, self report measures are as reliable as more complex measures such as food frequency or food diary measurements when used for intervention studies. The authors tested a single item measure (about how many servings of fruit and vegetables do you usually eat or drink on an average day?) against two summary questions (how many servings of fruit...? How many servings of vegetables) as used by Block, Hartman, Dresser, Carroll, Gannon and Gardener, (1986). Piloting showed that the single item measure produced a mean of 3.4 compared to a mean of 3.9 in the two question measurement which took longer to administer, thus the brief measure was chosen for assessment.

Block et al (1986) found that their summary questions for fruit and vegetables corresponded with national average measurements derived from the Second National Health and Nutrition Examination Survey (NHANES II; Life Sciences Research Office, 1989). These questions were used as part of a self-administered measure of dietary intake. Block & Hartman (1989) discuss issues in reproducing and validating dietary studies. They conclude that whilst participants completing dietary measures may be prone to error, it is much more likely that error occurs as a result of the investigator and instrument itself. Therefore it is important to consider the variability of the measure, problems with response formats, appropriate coding mechanisms and natural changes in dietary behaviour over different time periods.

Krebs-Smith et al (1995a), Cox, Anderson, Reynolds, McKellar, Lean and Mela (1996) and Bingham, Gill, Welch, Cassidy, Runswick, Oakes, Lubin, Thurnham, Key, Roe, Khaw and Day (1997) found that studies which use a larger number of questions tendend to find higher levels of consumption. However Serdula, Byers, Coates, Mokdad, Simoes and Eldridge (1992) found that grouping foods into single questions lead to under reporting for fat intake. It is evident that the type of behaviour being measured is important for classifying intake.

Williams (1995) discusses the confusion about what is an appropriate serving size and what constitutes fruit and vegetables. The lack of clarity over these issues may effect realistic measurement of intake. For example people need to be aware that potatoes and other starchy staples (e.g. yams and plantain) are not classified as a vegetables and also that it is important to eat a variety of different kinds of fruit and vegetables because they contain varied levels of appropriate nutrients.

The evidence suggests that a self reported measure is the most convenient, and is reliable as long as there are clear markers of what constitutes a serving size. For use in large scale surveys this is the easiest method to administer and to record data because it can be completed by the individual alone in a brief time period. It is evident that whatever method of measurement is used in examining intake of fruit and vegetables, the majority of the population are not eating enough. Issues about validity are not quite as important in intervention studies, where change in dietary behaviour is the measured outcome.

Although these methods have been shown to be fairly reliable, there has been little work which looks at the validity of self-reported measures. Recent development of biomarkers for intake may be useful in the future. The most commonly used biomarkers are plasma levels of carotenoids or vitamin C. The major problems with such measures at the moment is that they are very expensive and also invasive, so not appropriate for many surveys. Future biotechnological developments might be able to produce good, cheap, non-invasive methods, based on, saliva samples for example. At the present time there is little work which uses biomarkers as measures of intake so investigative surveys and intervention studies still rely on self reported measures.

Summary

It is widely accepted that fruit and vegetable intake is an important part of a low risk diets, especially in terms of cancer and heart disease. It has been estimated that by increasing fruit and vegetable intake to at least 400 grammes a day there would be a substantial reduction in incidence of cancer and heart disease. Present consumption levels in the UK and the majority of Westernised countries are well below this recommended amount. There have been found to be clear differences in intake levels by demographic characteristics such as gender, age, education and socio-economic status. These factors suggest that increasing fruit and vegetable intake is an important eating behaviour to be addressed. However why the low levels exist, specifically for different demographic groups needs to be investigated to give a clearer understanding of how to instigate change. One of the easiest methods of measuring intake of fruit and vegetables is based on a brief self-reported measure, where subjects rate their own intake levels. This has been shown to have reasonably reliability.

Cognitive influences on eating behaviours

Introduction

Food choice is generally understood to be the product of a range of influences including *environmental* e.g. availability (Shepherd, 1989), *cultural and social* e.g. social group norms (Krondl & Lau, 1982), *affective* e.g. preferences for taste or textures (Logue, 1991) and *cognitive* e.g. knowledge, attitudes, beliefs and barriers (Michela & Conteno, 1986). These factors have been summarised in two papers by Shepherd (1990) who looked at an 'overview of the factors influencing food choice' and Parraga (1990) who looked at 'determinants of food consumption'. Both of these papers identified beliefs and attitudes as central constructs in understanding food choice, although there is complexity in the factors involved.

Environmental influences on eating behaviour cover a myriad of topics such as availability, price and setting of food provision. In the past ten years there has been enormous change in the types and ranges of foods available in shops and other outlets. The 'types' of foods available now include low fat, low cholesterol, low sodium, low caffeine, healthy eating, genetically modified and organic to name but a few. With more processed foods there are greater temptations for taste. For fruit and vegetables increased availability means that there is unlikely to be such a strong seasonal effect on intake levels as most fruits and vegetables are available all year round. Thus the choices available mean that there are many factors to consider.

Another set of important factors are cultural and social influences on dietary behaviour, which cover a variety of different topics. There are different cultural influences on food choices which are a consequence of being a member of a certain group. Religion can dictate which foods can and cannot be eaten, while there are also cultural norms for eating behaviour for different ethnic groups. People tend to eat similar foods to other people in their social group. Gender, age and education are some demographic characteristics which have been found to be associated with some of the differences in food choices. In a large study conducted across Europe, Lennernas, Fjellstrom, Becker, Giachetti, Schmitt, Remaut de Winter and Kearney (1997) looked at the different influences on food choices. The authors found that there were greater differences on perceived influences by demographics (age, gender, education) than culture (country). Female, older and better educated participants were more likely to choose 'trying to eat healthy' as a major influence. Meanwhile Wardle et al (1997) in another pan European study again found that females consumed healthier diets (as measured by lower fat intake, greater fruit and vegetable intake) than males. These group differences may be a product of differences in other factors relevant to food choice such as attitudes or knowledge.

Taste and preferences are two hedonic influences on food intake. Research has shown that there is a general tendency to like sweet and salty tasting foods. These preferences appear to be innate (Desor, Maller and Andrews, 1975) and may result from evolutionary pressures to maintain energy supplies and salt balance (Bloch, 1978). This could account for preferences for the taste of ready made foods which tend to have higher salt and sugar content. These types of food also tend to be more unhealthy. There is also evidence for learned taste preferences, with tastes that are associated with stronger post-ingestional caloric consequences being preferred when hungry which may underpin the popularity of energy dense foods (Booth, 1985).

As well as these general influences, there are also individual differences with most foods attracting a range of preferences. Sometimes these preferences can be shown to be characteristic of groups. Logue and Smith (1986) in a study of adults and families found that females tended to prefer low calorie foods while younger participants preferred sweeter foods. The differences in liking for low calorie foods in older women may be a result of social pressures to reduce caloric intake rather than a preference for taste. Environmental, cultural, social and hedonic factors tend to be established either by the individuals or by others around them. These factors may be more embedded than cognitive factors and thus more difficult to adapt, which may one of the reasons that interventions to change dietary behaviour have focused on attempting to change cognitive factors.

Cognitive factors

Cognitive factors are of central interest to psychologists studying factors associated with eating behaviour. Cognitive influences incorporate the individual's knowledge, attitudes and beliefs about a behaviour. One of the many ways of studying and attempting to change behaviour has been based on looking at the effects of knowledge and attitudes on behaviour.

Knowledge

Knowledge has been studied, to ascertain exactly what people know, but also to gauge the potential effect this has on dietary behaviour.

Levels of public knowledge

The majority of large studies on nutritional knowledge have been conducted in the US, many of which are concerned with characterising the level of public knowledge. Cotunga, Subar, Heimendinger and Kahle (1992) examined cancer prevention knowledge in a large sample (n=22,043) of participants taking part in the 1987 National Health Interview Survey. It was found that although 73% of the sample agreed that diet and cancer were related, 44% believed that there was nothing that could be done personally to reduce cancer and only 40% thought that poor eating practices increased the risk of getting cancer compared to 88% for cigarettes.

Patterson, Kristal, Lynch and White (1995) examined knowledge about the relationship between diet and cancer, the National Cancer Institute recommendations for diet, and knowledge about fat and fibre composition of foods in 1972 adults. They found that 36% of people across all age ranges did not believe there was a connection between diet and cancer, with only 28% believing that there was a strong connection. Twenty three percent of participants did not know any of the National Cancer Institute recommendations about dietary change to lower cancer risk, and only 25% of participants were aware of the recommended goals for both fat and fibre. The retsults also indicate that only 30% had adequate knowledge about fibre and fat composition of different foods. Both Cotunga et al (1992) and Patterson et al, 1995) indicate that the role of diet in cancer prevention is underestimated by the general public.

Krebs-Smith, Heimendinger, Patterson, and Subar (1995b) looked at predictors of fruit and vegetable intake in 2,811 adults in America and estimated that only 8% of the US population are aware that people should eat 5 or more servings a day. They found that over 60% of participants believed a person should be eating 2 or fewer servings of fruit and vegetables a day. Less than half believed that fruit and vegetables help prevent cancer and just over half believed they help prevent heart disease. Studies carried out in America consistently show low levels of knowledge in basic nutrition elements related to health. Nutritional knowledge about fruit and vegetable tends to be particularly poor.

In comparison to the larger studies carried out in the US, there are a limited number of studies which have looked at public knowledge about nutrition in the United Kingdom, and many of these have had small or selective samples of participants. Anderson, Umapathy, Palumbo and Pearson (1988) looked at nutritional knowledge in 128 patients in a general medical ward. Patients were asked questions about nutrition terms, knowledge about recommendations and understanding the practical application of the recommendations. The data were analysed to look at differences between groups in terms of their medical condition. Overall knowledge scores ranged from 23% to 95% but there was no indication about the proportions of participants who were aware of the particular aspects of knowledge. The study does show that even in a group of patients who have a medical condition which may require dietary changes, or who have been given dietary advice in the past, knowledge still remains low. Tate and Cade (1990) looked at public knowledge of dietary fat and coronary heart disease in 255 members of the general population from an initial sample of 400. This sample was systematically selected from an electoral role. At least 70% of the sample were able to answer 80% of the questions, but few knew about the relationship of dietary cholesterol and saturated fat to plasma cholesterol. The authors suggest that overall knowledge is relatively high although there are certain misunderstandings. However taking these figures into account less than half of the initial sample contacted had good nutritional knowledge.

In another study Butriss (1997) questioned 1,700 men and women about knowledge relating to healthy eating. This study was conducted with face to face interviews and involved 4 studies conducted over 3 years. Around 60% of participants believed that eating more fibre, less sugar, less fat and changing cooking methods were very important for a healthy diet. Thirty five percent of participants were incorrect in identifying foods with fibre in them while 75% incorrectly chose food with starch in them. When asked to choose food with polyunsaturates and saturates the majority of participants were incorrect. The results indicate that although participants are aware of general messages about changing dietary behaviour they were not able to apply this in a practical manner for choosing foods. These studies however did not look at specific nutritional knowledge about fruit and vegetables.

Parmenter, Waller and Wardle (2000) examined nutritional knowledge in 1040 participants contacted from GP patient lists, this time also looking at fruit and vegetables. Respondents were asked about experts' recommendations, nutrient content, food choices and the relationships between diet and disease. Ninety percent of participants were aware of recommendations to increase fruit and vegetable intake but only 30% of people knew that they should be eating 5 or more servings a day. Approximately a third of participants incorrectly answered questions asking them to categorise food by nutrient content. Furthermore, although 85% were aware of a relationship between the amount of fat consumed and disease, only 59% were aware of a relationship between fruit and vegetable intake and disease. Fewer than half thought that increasing fruit and vegetables intake would reduce the risk of cancer and heart disease.

The poor levels of nutritional knowledge evident in the US were also found in the United Kingdom with participants aware of recommendations for dietary change in general terms but not aware of specific recommendations for change. Knowledge about fruit and vegetable intake appears to be weakest although this was not investigated in many studies.

Demographic differences in knowledge

A number of the studies have found demographic differences in levels of nutritional knowledge (Cotunga et al, 1992; Krebs-Smith et al, 1995b; Patterson et al, 1995). In most of these, men were found to have lower levels of nutritional knowledge than women (Crawford & Baghurst, 1990; Parmenter et al, 2000); participants from lower SES (Tate & Cade, 1990; Butriss, 1997; Parmenter et al, 2000) and who had lower levels of educational level (Krebs-Smith et al, 1995b) also had lower nutritional knowledge. Wardle et al (2000) looking at nutrition knowledge in general practice patients found gender, education and social class were all significant predictors of nutritional knowledge. Men, those with lower education level, and who were of lower social class all having lower levels of nutritional knowledge. These studies indicate that educational interventions aimed at dietary change would be wise to take account of possible differences in demographic characteristics.

Summary of nutritional knowledge studies

The studies described indicate that overall nutritional knowledge levels are poor. With regard to knowledge about fruit and vegetable intake, there is especially poor knowledge about the recommended levels of intake with fewer than half of participants in the majority of studies being aware of the 5 a day recommendation. There is also poor awareness of the protective role of fruit and vegetable intake in relation to cancer and heart disease. Issues of food choices are not so relevant for fruit and vegetables, because they are much easier to identify than fat and salt in foods. Those studies that have examined demographic differences have shown that, men, participants with lower educational and SES levels have poor levels of nutritional knowledge. Therefore interventions to improve nutritional knowledge and subsequently behaviours might usefully focus on improving public awareness of recommended levels and the health benefits of eating more fruit and vegetables. There is also a need to focus on improving the knowledge of men and those from more deprived groups and those with lower educational levels.

The association between nutritional knowledge and dietary behaviour

The poor dietary practices found in the majority of studies alongside the poor levels of nutritional knowledge indicate that these factors may be associated. A number of studies have attempted to quantify this association, although the focus of studies have been on general nutritional knowledge and specifically intake of fat.

American and European studies

The studies which look for associations between nutritional knowledge and eating behaviour have used a variety of different nutritional knowledge measures. Werblow et al (1978) looked at general nutritional knowledge and also knowledge specific for athletes, among 94 female students. Dietary behaviour was assessed by food patterns and categorised according to athletic status (e.g. training weight control diet or pre-event weight control diet). Apart from training weight control diet and pre-event weight control diet, nutritional knowledge was not found to be correlated with diet. The results suggest that other weight control factors may be relevant for dietary behaviour in this group. Perron and Endres (1986) also looked at the association between nutritional knowledge and dietary behaviour amongst 26 high school athletes using the same measure used in the previous study (Werblow et al, 1978). They found that there was no association between nutritional knowledge and behaviour. Although no or poor associations were found between knowledge and behaviour in both of these studies, the relatively small but select sample sizes mean that these findings can not be generalised to other groups.

In another study Stafleu, Van Staveren, De Graaf, Burema, and Hautvast (1996) looked at nutritional knowledge and fat intake amongst three generations of women. They found that there were no significant correlations between nutrition knowledge and percentage energy from fat intake. The nutritional knowledge measure was adapted from an instrument by Paas, Schneijder, Wedel, Stafleu and Lowik (1994) based on nutritional guidelines. It was found that there were low levels of knowledge overall which may reflect problems with the questionnaire for assessing knowledge for making appropriate food choices. The authors question the value of using nutrition education for dietary change.

Axelson, Federline and Brinberg (1985) carried out a meta analysis to look at the relationship between dietary behaviour and nutrition knowledge. Studies were selected where there were measures of dietary behaviour and nutrition knowledge (also attitudes to be discussed later) and where correlations between these factors had been calculated. Altogether 9 studies from 1963 to 1980 were selected for analysis with 6 of them using nutrition knowledge questions from Eppright (1970). Correlations between nutrition knowledge and dietary behaviour ranged from 0.03 and 0.32. When conversions of effect size estimations were calculated nutrition knowledge was significantly correlated with dietary behaviour (r =0.1), but the effects sizes was regarded as small. The variations in the quality of measurement of intake as well as that of nutrition knowledge, may have contributed to this small effect size. Although this study attempted to quantify the association between knowledge and dietary behaviour, this meta-analysis was conducted on a limited number of studies with varied sample sizes which makes them more difficult to compare. Nevertheless although the authors indicate that the association is not important based on the small effect size, it could be said that correlations of 0.21 if causal, imply useful leverage of dietary behaviour through education.

Other studies have looked at nutrition knowledge which is specific to disease, especially cancer and heart disease. Patterson et al (1995) looked at the association between diet-cancer knowledge and healthful diets. They looked at beliefs in a diet-cancer relationship, knowledge about recommendations and knowledge about food composition regarding fat and fibre. All three nutritional knowledge factors were related to healthful diet changes, percentage of energy from fat and grammes of fibre even when demographic characteristics were taken into account. Participants with the highest levels of knowledge were more likely to have made healthful diet changes, had lower percentage of energy from fat and consumed more grammes of fibre. In another study, Patterson, Kristal and White (1996) looked at nutritional knowledge as a predictor of dietary change over three years using a similar type of sample as the previous study. They found that over three years those participants who believed there was a strong link between diet and cancer made more healthful dietary changes, and greater reductions in the percentage of energy from fat and increased the amount of fibre in their diet more. There were similar findings for knowledge about recommendations although there were no significant differences in intake in relation to knowledge about food composition.

The indications from these studies are that the variability in association between knowledge and behaviour could be as a result of the different type of nutritional knowledge measured. Some of these studies have used knowledge about nutrient content, others have used knowledge about diet and health. As well as this, differences in samples and food measurements make it difficult to decide the degree to which nutritional knowledge is relevant to dietary behaviour.

British studies

Few studies have been conducted in the UK to examine the association between nutrition knowledge and behaviour. Shepherd and Stockley (1987) looked at the association of nutrition knowledge and fat consumption. Behaviour was assessed by intention to consume meat, meat products, butter and margarine and milk. In this study the nutrition knowledge score was not found to correlate with intention to consume the different foods. One of the reasons that the authors suggest for the apparent lack of association between knowledge and behaviour is the general nutrition measure used. This measure was brief and general and thus may not have been related to the specific behaviours measured. Subsequently, Shepherd and Towler (1992) looked at the association of nutrition knowledge and fat consumption using a validated nutritional knowledge questionnaire. The nutritional knowledge questionnaire asked about nutrient density of the foods as well as multiple choice questions (Towler and Shepherd, 1990). Fat intake was assessed by a one item self reported measure of meat, meat products, dairy products and fried foods. Analysis showed that there were significant correlations between total knowledge scores and intake for meat and meat products but not for dairy products or fried foods. Higher knowledge about the fat content of meat and meat products was associated with a lower intake, but the authors conclude that knowledge is related with intake to a limited degree if at all, based on the results shown.

A recent study carried out in the UK examined the relationship of specific nutritional knowledge to intake of fruit, vegetables and fat (Wardle et al, 2000). Using a validated Nutrition Knowledge Questionnaire (Parmenter & Wardle, 1999), intake and knowledge was assessed in patients contacted via GP lists. There were strong associations found between overall nutritional knowledge and intake of fruit (0.23), vegetables (0.36) and fat (-0.21). Due to the clear demographic differences in nutritional knowledge, multivariate analysis was carried out including demographic characteristics. The result showed that nutritional knowledge was a significant predictors of intake of fat, fruit and vegetables and also overall healthy eating. Nutritional knowledge was found to mediate the demographic differences in intake. The results indicate that it is important to extend nutritional knowledge beyond fat and fibre to other aspects possibly relevant to change. Using a well validated measure of nutritional knowledge which was specific to the foods being assessed, revealed strong associations between knowledge and intake.

Validity and reliability of nutritional knowledge measures

One of the reasons why there have been shown to be poor associations between knowledge and behaviour in some studies might be the measures being used. The variations in dietary measures and their reliability and validity have been discussed earlier. It is now important to look at research which has attempted to test the reliability and validity of nutritional knowledge measures. Many studies have relied on unvalidated or poorly validated measures. This lead to validated measures being created by Towler and Shepherd (1990) and Parmenter and Wardle (1999). Towler and Shepherd (1990) developed a questionnaire that could be used in general groups of the population to look at the relationships between knowledge and behaviour. Nutritional professionals (27) and undergraduate students (55) completed a questionnaire with sections about nutrient density and multiple choice. Participants had to identify ten foods from a list of twenty with high nutrient content for protein, carbohydrate, fat and fibre, as well as multiple choice questions. The nutrition professional group scored significantly higher on all of the nutrient questions and multiple choice questions. The authors conclude that the results indicate this is a robust and valid measure for assessing nutritional knowledge in the general population. One feature of this questionnaire was that it was focused less on actual foods than the nutrient properties of foods so it might be less relevant to dietary behaviour. Little is said about how the question items were constructed and there is no cover of actual recommendations.

Parmenter and Wardle (1999) who reviewed the psychometric validation of nutrition knowledge questionnaires found that one of the areas which has been missed out in such questionnaires was knowledge other than that about fat and fibre. Their questionnaire was developed by pooling information from existing questionnaires and the literature. From an initial pool of 1201 items, this was reduced to 102 by a panel of psychologists and dieticians. After much piloting the construct validity and test-retest reliability were tested among dietetic and computer science undergraduate students. Knowledge sections were broadly divided into dietary recommendations, sources of nutrients, choosing everyday foods and diet-disease relationships. Results indicated that there were significant differences between the two groups of students indicating good construct validity. Internal reliability showed an overall Cronbach alpha score of 0.97 and test-retest reliability had a correlation of 0.98. The authors conclude that this questionnaire is a valid and reliable measure of nutritional knowledge, and the broad subjects cover mean that gaps in nutritional knowledge can be identified using it.

Attitudes

One other well established cognitive structure that has been investigated in relation to dietary behaviour is attitude. Studies examining attitudes can broadly be split into two types, those which use attitudes to look at food choices and those which look at attitudes in relation to dietary change. Shepherd (1990) identifies three components of attitudes: affective (feelings of liking or disliking towards an object), cognitive (information about the object) and conative (tendency to behave in a certain way towards the object).

Attitudes and food choice

Attitudes about food choice can reflect beliefs about particular foods e.g. fruit is healthy, as well as beliefs about particular aspects of foods e.g. fruit tastes good. Early work looking at attitudes towards foods tended to use general measures of attitudes. These studies often used semantic differential scales to assess factors such as good and bad, healthy and unhealthy aspects of different foods. Often health is highlighted as one attitudinal factor relevant to food choice although this is by no means the only one. Specific attitudinal factors which arise in the literature repeatedly are 'taste', 'price' and 'convenience' to differing degrees. The relative importance of these attitudes is likely to be different for different types of food choice. Lennernas et al (1997) examined factors associated with general food choice. Participants had to select the three most important factors derived from a list drawn up by food scientists as relevant factors. The results showed that quality, price and then taste were rated highest for influencing food choices. This was followed by 'trying to eat healthy'. However studies on choice of fatty foods tend to find taste as more influential (Albright, Flora and Fortmann, 1990, Towler and Shepherd, 1992).

Steptoe, Pollard and Wardle (1995) developed a questionnaire to look at the motives influencing people's dietary choices. Using factor analysis on a 68 item questionnaire, they found that 9 factors emerged which were health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern. Sensory appeal (e.g. tastes good) consistently had the highest mean rating with health, convenience and price also having higher ratings compared to the other factors. Steptoe et al also report significant differences by gender with women having higher ratings than men on all of the factors apart from sensory appeal and familiarity (e.g. is what I usually eat). The studies on attitudes indicate that sensory appeal, convenience and health are all relevant to food choices regardless of the type of food being examined.

Attitudes and dietary change

Increasingly more work has been carried out to look at what attitudinal factors may prevent people from making appropriate dietary choices. These factors are often called perceived barriers. Negative attitudes to foods only become barriers when they are placed within a social or environmental context. Lappalainen, Saba, Holm, Mykkanen, Gibney and Moles (1997) looked at the perceived barriers to healthy eating in 14331 participants across Europe. Some of the barriers which were highlighted included lack of time, difficulty in giving up favourite foods and will power. There were wide variations in the factors mentioned as barriers between European countries taking part with more people in the UK mentioning price as a barrier than in Germany or Italy. There have been a few studies which have looked at specific barriers to fruit and vegetable consumption. Cox, Anderson and Lean (1995) found that people identified the cost of fruit and vegetables as a significant perceived barrier to intake. Treiman, Freimuth, Damron, Lasswell, Anliker, Havas, Langenberg and Feldman (1996) looked at barriers specifically in a group of low income women to eating more fruit and vegetables and found that availability, problems of preparation and lower preference were all perceived as barriers. Common barriers to fruit and vegetable consumption across studies are price, difficulties of storage and availability which seem to focus on the more practical elements of food choice than other food types. These studies did not look at possible differences in barriers by SES level although there is some indication that the influence of others is perceived as a greater barrier for women than men (Cox et al, 1995; Lappalainen et al, 1997).

Attitudes and behaviour

One of the principle reasons for having an interest in attitudes to food that attitudes are significant influences on food intake. Consequently associations between attitudes and behaviour have been widely studied, especially in the dietary behaviour field. The early studies which did not use theoretical frameworks tended not to find relationships between attitudes and food choice (Foley, Hertzler and Anderson, 1979). One of the problems with these studies is that they lack a clear definition of what attitudes are. However subsequent investigations have broadened the scope of attitudes being studied as well as applying these in a more structured manner (to be discussed under Theoretical Models).

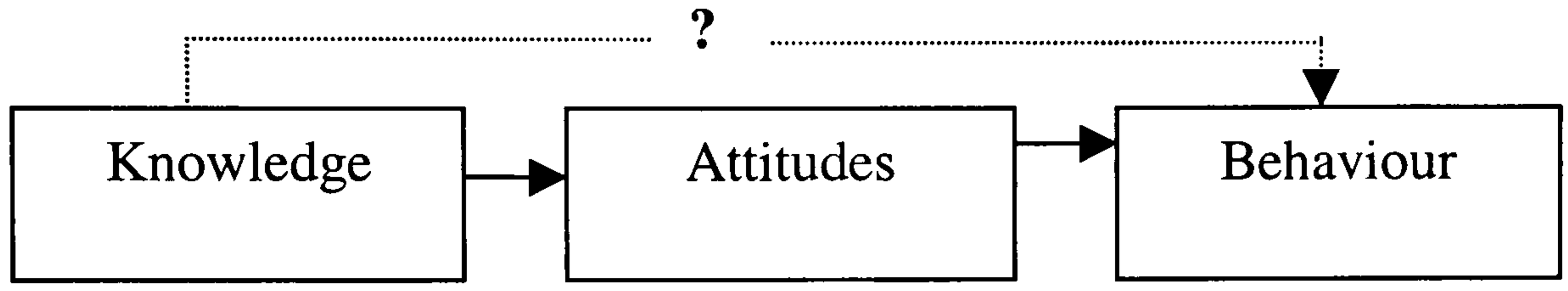
Shepherd and Stockley (1987) using a theoretical framework (Theory of Reasoned Action), looked at the association between attitudes and fat consumption as measured by intention to consume meat, meat products, butter and margarine and milk. Attitudes were measured by assessing general perceptions of pleasantness and harm of the foods specified and were found to correlate with intentions to eat all of the four food types measured.

In another study Dittus, Hilliers and Beerman (1995) based their investigation on the Health Belief Model to look at the relationship between different attitudes and fruit and vegetable intake. Attitudes investigated included; barriers and benefits as well as concerns about nutrition. The barriers related to items such as cost and availability whilst benefits related to health benefits such as prevention of cancer. The authors also reported that barriers to fruit and vegetable intake were the largest component of variability in actual consumption. Barriers were seen as greater by men and those with lower income and less formal education.

Nutritional knowledge, attitudes and behaviour

Many of the studies already discussed have looked at the independent effect of knowledge on behaviour and also attitudes on behaviour. Social psychologists have postulated that people acquire knowledge which lead to the development of attitudes and in turn to a behaviour conducive with those attitudes. Thus, knowledge works through attitudes in effecting behaviour and not necessarily directly on behaviour (see Figure 1).

Figure 1 The knowledge, attitudes and behaviour relationship



However there are very few studies which have looked how these factors interact with each other, and any subsequent impact on behaviour.

Axelson et al (1985) in their meta analysis which looked at the relationship between dietary behaviour and nutrition knowledge and also between dietary behaviour and attitudes to food and nutrition found that the association was stronger between attitudes and behaviour, than that of nutrition knowledge and behaviour. They suggest that attitudes are a more relevant factor to dietary behaviour than knowledge. However in this meta-analysis there was a lack of similarity between assessment measures in the studies used. Only four of the studies measured attitudes and of these, in two studies the attitude factors resemble nutrition knowledge factors whilst the other two studies did not look at specific attitudes.

In another study Grotkowski and Sims (1978) looked at the association between nutritional knowledge, attitudes about nutrition and diet, and nutrient intake among 64 adults aged over 62 years. Nutrient intake about energy, protein, fat intake, carbohydrates and more specific nutrients (calcium, iron etc.) was calculated from three day diet records. Nutrition knowledge was measured using multiple choice questions and the results obtained showed a low level of overall nutrition knowledge in this elderly sample. Additionally participants were asked about self-evaluation of knowledge which showed that while perceived knowledge and actual knowledge were correlated, participants tended to over rate their knowledge in comparison to professional dieticians. The results also showed that nutrition knowledge was not directly related to nutrient intake, although self-evaluation of knowledge was. Of the attitude components measured only misconceptions about weight reducing diets and vitamins/mineral supplements being necessary were correlated with some nutrient intake. Nevertheless the authors conclude that attitudes intervened between knowledge and behaviour based on the associations between attitudes and knowledge. This study has several methodological weaknesses to it, which may affect the generalisability of the results. Firstly it was conducted on an elderly sample with characteristically low levels of nutritional knowledge, thus showing little variability in scores. As well as this, the measures of intake were nutrient based and not food based, and also the attitudes were very much focused on nutrition aspects and thus could be construed as more knowledge items than attitudes. Despite these criticisms its is suggested that improving nutritional knowledge is an important feature of behaviour change.

Summary of research

Varied levels of association between nutrition knowledge, attitudes and dietary behaviour have been reported. The early studies investigating the relationship between knowledge and behaviour indicated that there was a weak association. However the measures used in these studies lacked validity or reliability so effects may have been underestimated. It was not until relatively recently that nutritional knowledge measures were designed with validity and reliability in mind. Using such measures showed that higher levels of knowledge were strongly associated with better dietary behaviour, especially for fat, fruit and vegetable consumption. The links between attitudes and behaviour are thought to be much stronger and it has been shown that negative attitudes are related to lower intake of certain foods. One theory is that knowledge has its effect through attitudes, hence the attitude-behaviour relationship tends to be stronger. Therefore a combination of low nutritional knowledge and negative attitudes is likely to be associated with even poorer dietary behaviour. However there are very few studies if any at all which have looked at both the independent and combined effect of these cognitive factors on behaviour. One of the weaknesses of these studies is that they do not use a theoretical framework for studying dietary behaviour. As a result it is not clear how knowledge and attitudes work together in effecting behaviour.

Theoretical models for studying dietary behaviour

Several theoretical models of behaviour have been used in the study of health behaviours including dietary behaviours. The most favoured models are based on social cognition theory which involves 'assessing different features of an individual's beliefs in order to predict future behaviours' (Conner and Norman, 1996), although recently, stages-based models have also been used to look at changes to behaviour. Only those models which have been used in the investigation of dietary behaviours will be discussed here. The most widely applied models in dietary behaviour work are the Theory of Reasoned Action, Theory of Planned Behaviour, and the Attitudes-Self-efficacy Model. All of these models address individual's cognitions relevant to social situations and include attitudes as one of the main constructs of these models. A brief summary of the models and a description of relevant research will follow. This will be followed by a more in-depth review of the stages of change model and its application to dietary behaviour.

The Theory of Reasoned Action

The theory of reasoned action was one of the earlier social cognition models which was developed in the early 1970's in the area of social psychology. Originally used to explain behaviours such as consumer decision making (Ryan and Bonfield, 1975) and voting behaviour (Shepherd, 1987), the model has more recently been applied to different health behaviours such as breast screening (Montano and Taplin, 1991) and smoking cessation (Gottlieb, Gingiss and Weinstein, 1992). The TRA framework has been used to investigate the role of attitudes and subjective norms in the prediction of behavioural intention, and the role of behavioural intentions in the prediction of actual behaviour (see Figure 1). Ajzen and Fishbein (1980) proposed that changes in attitudes would lead to changes in social behaviour. Attitudes are the individual beliefs about a behaviour and behaviour change which are the product beliefs about behavioural outcomes (e.g. smoking causes cancer) and the evaluation of this outcome (i.e. cancer is bad for you). These can include either positive or negative factors. Subjective norms are the product of normative beliefs and motivation to comply. Normative beliefs in turn, are the beliefs that individuals think important others hold regarding a behaviour (e.g. people who are important to me think I should give up smoking), and the value placed on these beliefs (e.g. how much do you want to do what your friend think you should). Behavioural intention is the intention to change or adopt a specific behaviour, often described within a set time frame (e.g. tomorrow, within 6 months, in the future). According to the TRA behavioural intention is the best predictor of behaviour, although attitudes are thought to directly relate to behaviour.

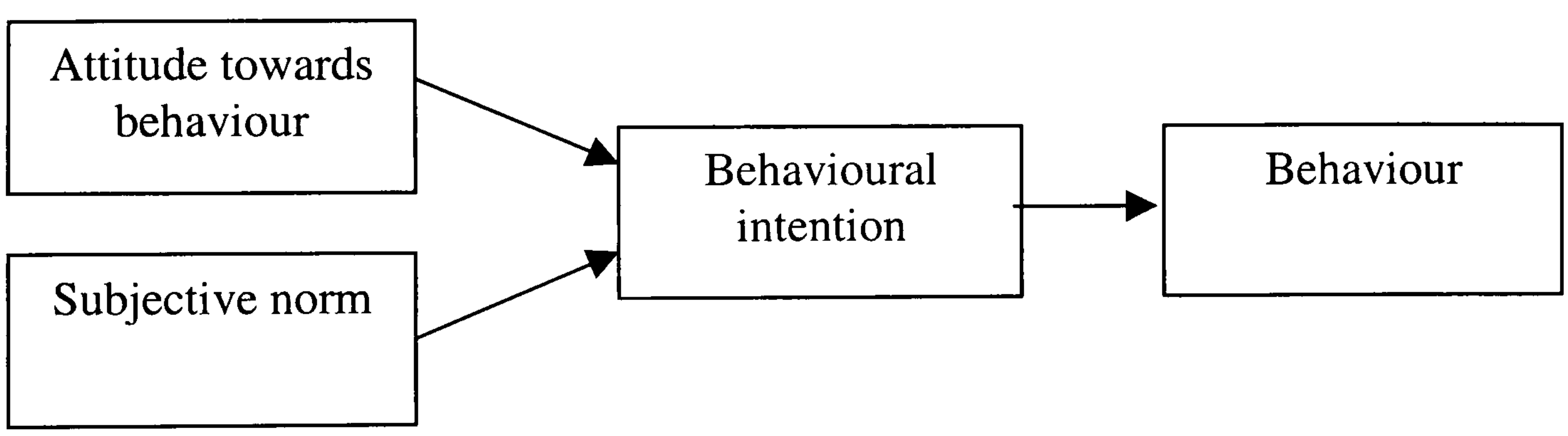
As already pointed out the model has been used to look at different aspects of behaviour, sometimes to test the efficacy of the model in predicting behaviour, and occasionally to test certain components of the model. Some of the dietary behaviours which have been investigated include milk consumption (Tuorila, 1987), salt intake (Shepherd and Farleigh, 1986) and fat intake (Towler and Shepherd, 1992). Tuorila (1987) looked at intention to drink non-fat, low-fat or regular-fat milks amongst 236 supermarket shoppers. Participants were stratified to select a sample that varied by type of milk used as observed in their baskets. Whilst in the supermarket, participants tasted and rated different milks. Questionnaires were then taken home to be completed within the next week. The questionnaire consisted of items on attitudes to milk selection (e.g. extremely bad to extremely good), beliefs about selecting different milks (e.g. sensory properties, health aspects, suitability and price), evaluations of these beliefs and subjective norms. Behavioural intention was measured by likeliness to buy the different types of milk when shopping next. Multiple regression analysis indicated that attitudes and social norms explained between 18% and 36% of the variance in intention to buy the different milk types, and between 28% and 47% of the variance in actual behaviour. Social norms were not significantly related to either non-fat or low-fat milk intentions, or low fat milk intake. The model was most useful at predicting both intention and behaviour for the regular fat milk, although attitudes were consistent predictors for all types of milk. The majority of participants in this study were low fat milk users who therefore might be less interested in important other's beliefs about buying low-fat milk. There were differences by age and education amongst the different milk users which may also have an impact of the predictors.

Two studies by Shepherd and Stockley (1987) and Shepherd and Towler (1992) applied the theory of reasoned action to investigate predictors of fat intake. In the first study, nutritional knowledge, and the TRA variables of attitudes and subjective norms were investigated in 210 adults recruited at an exhibition on food. Participants were mainly women (63%) aged under 35 years of age (70%). Consumption of meat, meat products, butter/margarine and milk was measured using a food frequency questionnaire. Attitudes were assessed in relation to the behaviour (i.e. eating meat is beneficial) as opposed to the food itself and subjective norm reflected pressure from important other to behave in a certain way. There were significant correlations between subjective norm and behavioural intention (r= 0.31-0.46) and also between attitudes and behavioural intention (r=0.42-0.62). Regression analysis showed that attitudes were a better predictor of behavioural intention than subjective norms. The results indicate good applicability of the theory of reasoned action to different dietary behaviours relating to fat intake. The demographic differences in attitudes may have had impact on the generalisabilty of the results due to the demographic makeup of the sample. Both of these studies illustrate the importance of the attitude component in the theory of reasoned action for predicting behavioural intention and behaviour where measured. A weaker effect of subjective norms was shown in both studies which suggests this may not be relevant for certain types of dietary behaviour. Sampling issues mean that these results can not be generalised especially as both samples were recruited at a time when there may have been heightened sensitivity to cognitive factors related to food intake.

Shepherd and Towler (1992) used the structural components of the model to investigate both attitudinal predictors of behavioural intention and behaviour. The sample of 538 participants was recruited from the work place. Behaviour was measured by intake of meat, meat products, dairy products and fried foods. As in the previous study the impact of knowledge on attitudes and behaviour was investigated, however the normative belief component was not measured because of the poor association with behaviour in other studies (Tuorila, 1987). General attitudes to consuming the different foods were assessed and also the beliefs about outcome of the behaviour, and evaluations of these outcomes, were included. Beliefs reflected common themes identified in structured interviews, some of which were the same for each of the four foods (e.g. meat is healthy, high in fat and tasting good) whilst the evaluations related to this belief (e.g. food which is high in fat is desirable). The results indicate that there were significant correlations (r= 0.58-0.70) between the general attitude measure and measure of the product of beliefs and evaluation. Also there were strong correlations between general attitudes and intention (0.40-0.64) and also intention and behaviour (0.57-0.78) for all four food groups. Cognitive factors relating to diary products were found to have the weakest associations. The results support the previous two studies with good association between attitudes and behavioural intention and behaviour. The weaker effects found for diary foods may be a consequence of the wide range of foods that can be incorporated into this category. Previously for example, milk and spreads were analysed separately.

The evidence from applying this model is that attitudes are a significant predictor of both intention to change behaviour and actual behaviour, however the role of normative beliefs appears much weaker for dietary behaviour. The views of others do not appear to be as important as one's own beliefs about a specific behaviour. Research which applies other theoretical models may offer some insight into other more relevant factors. These studies have been used for illustrative purposes and not as an exhaustive list of studies which have applied the Theory of Reasoned Action to dietary behaviours.

Figure 2 Theory of Reasoned Action



Theory of Planned Behaviour

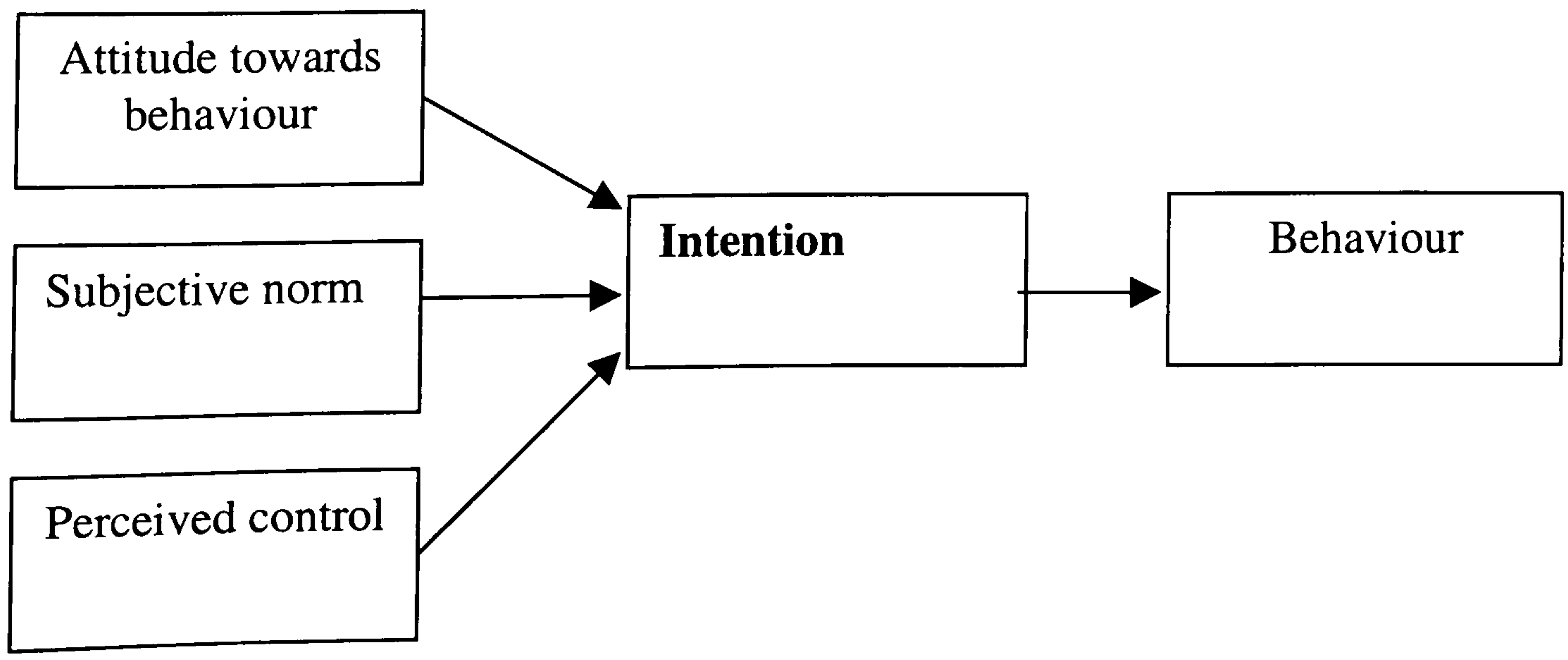
The theory of planned behaviour (Ajzen, 1988) is a further development of the Theory of Reasoned Action. The model was developed in the 1980's to address behaviours which were not under complete volitional control and has been used subsequently to look at a variety of health behaviours and mental health problems. In this model the component of perceived control has been added so that the model could be applied to behaviours over which the individual has no control (See Figure 2). Perceived control is the personal control that the individual believes he or she has over performing a behaviour (e.g. 'whether I smoke or not is up to me'). Some of the specific behaviours examined include cannabis use (Conner & McMillan, 1999), and condom use (Nucifora, Kashima and Gallois, 1993) as well as smoking behaviour (Godin, Valois, Lepage and Desharnais, 1992), screening attendance (Conner & Norman, 1994), exercise (Norman & Smith, 1995) and dietary behaviour (Conner, Povey, Bell and Norman, 1994).

Food choice studies that have utilised the TPB include studies focusing on changing to a low fat diet (Lloyd, Paisley and Mela, 1993), consumption of organically grown vegetables (Sparks and Shepherd, 1992), adolescent food choices (Dennison and Shepherd, 1995) and mothers' intention to limit infant's sugar intake (Beale and Manstead, 1991). In their review of social cognition models, Conner and Sparks (1996) provided a detailed description of how the model works when applied to dietary behaviour, illustrated by a study on attitudes to healthy eating (Conner et al, 1994). In this study attitudes, subjective norm, and perceived control were examined as possible predictors of behavioural intention and behaviour. Attitudes to consuming a healthy diet were measured by semantic differential scales reflecting general attitudes to behaviour change. Subjective norm was measured as the importance put on friends and families opinions of behaviour change, and perceived control with various items such as confidence of change. Behavioural intention was measured as intending to eat a healthier diet within the next 6 months. The results demonstrated that all three psychological components were significant predictors of behavioural intention. The model did not predict much of the variance in behaviour (5%), however this is not surprising considering the broad measures of attitude, social norm and perceived control contrasted with the specific measure of behaviour (e.g. calorie intake).

In a more focused study Cox et al (1996) looked at predictors of fruit and vegetables using the Theory of Planned Behaviour. Participants were recruited from census data which was stratified to select people who were from lower SES groups and also more people from Scotland because the Scottish are known to consume especially low levels of intake and therefore to be most in need of change. Response to the study questionnaire was poor with only 714 (37%) of the initial 2020 people returning usable questionnaires. General attitudes were measured (e.g. my attitude to increasing fruit is unfavourable), as were specific beliefs (e.g. vegetables are difficult to prepare) along with evaluations of these beliefs (e.g. choosing foods which protect my health). Other components measured were perceived control, subjective norm and intention to eat more fruit, vegetables and vegetable dishes. Intake was assessed with a food frequency questionnaire. Multiple regression analysis showed that the components of the TPB model were significant predictors of intention to eat more fruit, vegetables and vegetable dishes. Of the three components (attitudes, subjective norm and perceived control), perceived control (β 0.12-0.16) was found to be the weakest predictor of intention whilst attitude was the strongest predictor (β=0.34-0.45), however the model was useful in explaining a large percentage of the variance (approx. 60%) in intake. The lower predictive value of perceived behavioural control could be a result of the type of people responding to the survey. Low response rates may have meant that certain types of people (i.e. people who have high perceived control) did not complete the survey, although little is known about this group. Overall, the study supports previous applications of the TPB model on behaviour. Attitudes are consistently shown to be significant predictors of behavioural intention and behaviour, although the other factors vary in significance.

Conner and Norman (1996) highlight some particular problems with the Theory of Planned Behaviour Model when applying it to dietary behaviour which may not exist with other health behaviours. The perceived behavioural control aspect may create problems because people are not aware of barriers that may affect their actual control (e.g. cost) so there may be little variation in control levels. Attitudinal factors related to food are changeable depending on the food type being assessed. For example people may be aware that foods high in fat are bad for you but the fact they taste good contradicts this (e.g. bad versus good). Additionally attitude factors are much more affective for food choice than other behaviours because of the hedonic experiences already encountered. Another aspect that sometimes differentiates food choice from other health behaviours is its abstract nature. Food choices are part of a continuous process and not a discrete process like giving up smoking. Thus having an intention to improve one's diet may not be the same as reducing the amount of fat in the diet or eating more fruit and vegetables.

Figure 3 Theory of Planned Behaviour



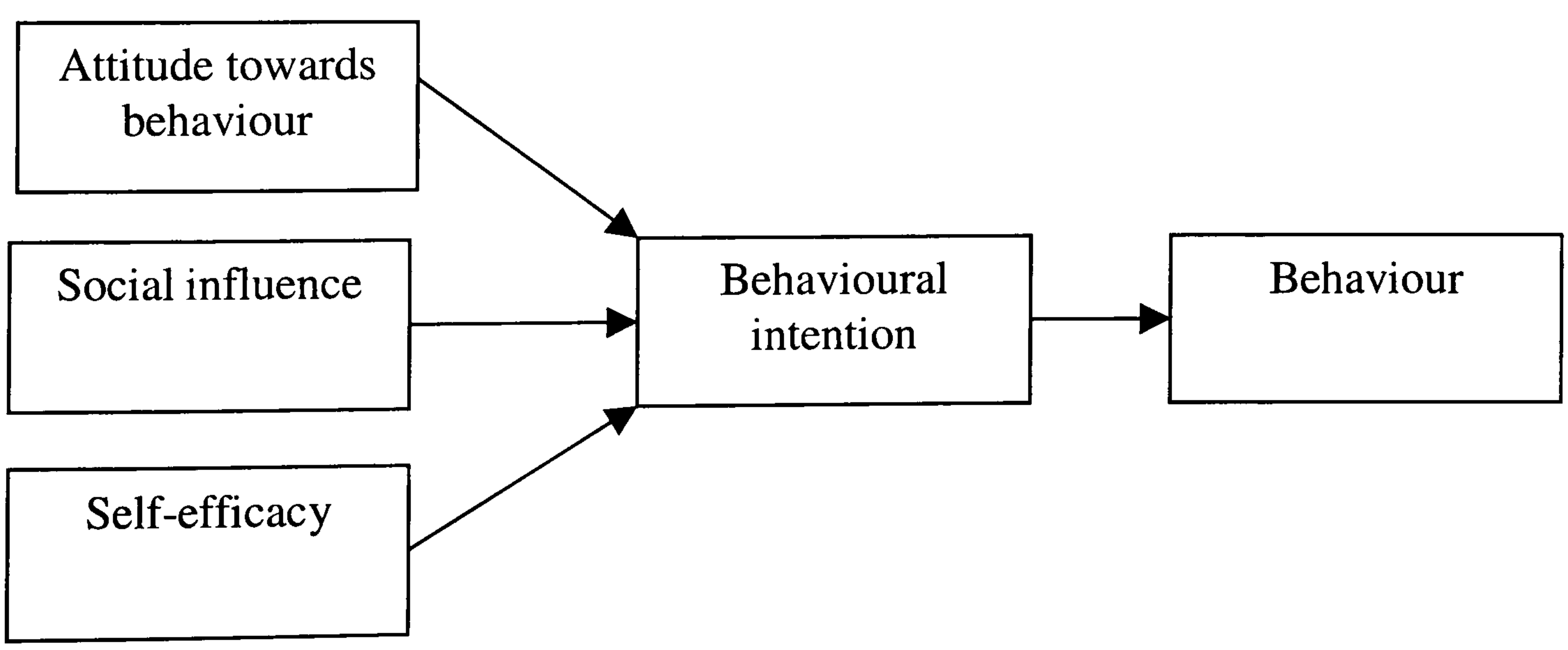
It is important to consider the measurement of the different components of the model when applying it to dietary behaviour, with an emphasis on construct validity and reliability. Different types of attitudes and perceived control may be relevant for different dietary behaviours (e.g. different issues exist for reducing fat compared to eating more fruit), which may mean that general attitudes are not as relevant. The suitability of these models for dietary behaviour has been based on relatively few studies compared to their application to other health behaviours. These studies have also tended not to report testing the validity of the measures used. Using this model to study dietary behaviour therefore needs to be done with some caution. Problems envisaged have led to adaptations of the model such as the ASE model as described below.

Attitude-Social Influences-Efficacy model

The Attitudes-Social Influences-Efficacy model (De Vries, Dijkstra and Kuhlmen, 1988) is an adaptation of the Theory of Planned Behaviour which integrates it with Social Learning Theory (Bandura, 1977). Because of the strong association between attitudes and intention in comparison to the other two components of the TPB model, attitudes remain one of the main components in this model. The ASE model uses self-efficacy and social influence instead of the traditional measures of perceived control and normative beliefs (See Figure 3), although these could just be alternative labels as essentially they are the same measures. Self-efficacy is the perceived ability to perform certain behaviours in different situations (e.g. I am confident that I can eat more fruit when I am eating out) whilst social influences are the perceived support (e.g. if I wanted to give up smoking my family would support me) and behaviours of important others (e.g. my friends drink more milk than I do). This ASE model has been used to look at participation in employee fitness programs (Lecher and De Vries, 1995) and smoking cessation programs (Backbier and De Vries, 1993), often in combination with the stages of change model (to be discussed subsequently).

Brug, Lechner and DeVries (1995) used the ASE model to look at the psychosocial determinants of fruit and vegetable intake. In this study the components of the ASE model were investigated for consumption of boiled vegetables, salads and fruit among a community sample of 598 adults selected using random digit dialing. Participants were asked a variety of belief-based questions related to intake such as health consequences, taste and price. Self-efficacy questions related to confidence of eating more in different situations (e.g. during weekends) and social influence measures included two questions about important social support from others for eating fruit, vegetables or salad and social comparison of important others intake levels. Intention was measured with a single item question about intention to eat more. Correlation and regression analysis showed that for intention to eat more salads, all three components were significantly associated. Intention to eat more boiled vegetables was associated only with attitudes and self-efficacy, and actual consumption of fruit was associated with attitudes and self-efficacy beliefs, although self-efficacy was the only significant predictor of intention to eat more fruit. Self-efficacy was the best predictor of intention for each of the food types which supports the work of Shannon, Bagby, Wang and Trenkner (1990). Similar to the work by Stafleu, De Graaf and Van Staveren (1991) on fat intake, social influences were the weakest predictors of intention. Analysis of behaviour showed that intention and self-efficacy were significant predictors of consumption of salad, boiled vegetable and fruit. Unlike the studies using the theory of planned behaviour or reasoned action, attitudes were not the largest contributor to intention or behaviour. The results of this study have implications for intervention studies which should consider the importance of changing negative attitudes and poor levels of self-efficacy.

Figure 4 ASE model



All of these social cognition models have attributes in common. The most common attribute which characterise these model is attitudes. Thus attitudes are thought to be significantly associated with intention to change behaviour and behaviour itself. There are however a variety of other relevant cognitions which have been found to be associated with behaviour and behavioural intentions.

Social cognition models have been used mainly to predict intentions to change behaviour or to predict behavioural change and not as a method for investigating the psychological factors associated with behaviour change. Thus they do not explain why people do or do not change their actual behaviours. However the strong associations found are useful indicators of factors relevant for behavioural change which should be incorporated into intervention design to target those factors which are most relevant to behaviour. The only model which has been widely used in the behaviour change field is the stages of change model.

Stages of change model

The stages of change model (Prochaska & DiClemente, 1983) was developed in the 1980's as a theoretical model for classifying individuals in relation to their readiness to change their health behaviours. It was most widely used to classify people in relation to their likelihood of responding to smoking cessation programs. Stages of change is one construct of the larger 'transtheoretical model' which also incorporates the processes of change, 'pros' and 'cons', decisional balance and self-efficacy or resisting temptation. It is called the transtheoretical model because it 'integrates processes and principles of change from different theories' (Prochaska and Velicer, 1997).

The stages of change

The most commonly cited stages of change in the literature are precontemplation, contemplation, preparation or decision making, action and maintenance.

Figure 5 Stages of change Model

Precontemplation ⟶ Contemplation ⟶ Preparation ⟶ Action ⟶ Maintenance

←----relapse←------- relapse ←-------relapse←--------- relapse

Individuals in the precontemplation stage are those with no intention to make changes to their behaviour and who have never made changes in the past. Contemplators are those considering changing their behaviour but not immediately (often defined as within the next month). In the preparation stage, a person intends to change their behaviour in the near future and is actively making an effort to do so. Those in the action stage have recently made changes in their behaviour, whilst maintainers are those who have made changes and maintained these for some time (often more than 1 month). However at any point along this scale individuals can relapse to an earlier stage. The time scales used have been selected to differentiate between intentions and change based on work with smokers. The movement through the stages is thought to be sequential although participants can relapse at any stage.

Staging for smoking cessation

The early work using the stage model was carried out with people who were trying to give up smoking, and it was used to help to understand why some individuals found it more difficult than other to make changes to their behaviour (Prochaska and DiClemente, 1982). From this work 5 stages were identified (See Figure 4) which could be characterised by different beliefs and expectations. In 1982, Prochaska & DiClemente talked about "seeking a synthesis for the increasing proliferation of therapeutic systems". In essence they wanted to understand the processes involved in clients committing themselves to behavioural change and preparing them for action. Verbal therapies were thought to be useful in getting participants to commit to making change. These included consciousness raising (information gain), self-liberation (self-reassurance) and social liberation (social coping) whilst behavioural therapies were thought to be used in preparing participants for action and these include stimulus control (active change), re-evaluation and counter-conditioning (creating alternatives). Prochaska & DiClemente (1983) applied the model to 872 smokers to look at the different processes associated with change. In this study participants were classified into precontemplators (12%), contemplators (21%), action (15%), maintainers (28%) or relapsers (22%). The authors suggest that consciousness raising is most highly rated in the contemplation stage whilst counter conditioning and stimulus control are most highly rated in action and maintenance stages. Thus self awareness seems important earlier on whilst behavioural strategies to avoid smoking are most useful in latter stages. It was concluded that there were identifiable differences between the stages of change of smoking cessation and these were useful when looking at ways of making behavioural change. The majority of studies (Boyle, O'Connor, Pronk and Tan, 1996; Laforge, Velicer, Richmond and Owen, 1999) looking at smoking behaviour using the stages of change model have found similarly low numbers of participants in the precontemplation stage (approx. 20%) which may reflect the pressures to give up smoking and also the ease of being aware of changes in smoking status.

Staging for dietary behaviour

More recently the stages of change model has been applied to dietary behaviour in the areas of increasing fibre (Glanz, Patterson, Kristal and DiClemente, 1994), reducing fat (Rossi, Rossi, Velicer and Prochaska, 1990; Curry, Kristal and Bowen, 1992; Greene, Rossi, Reed, Willey and Prochaska, 1994; Steptoe, Wiketunge and Doherty, 1996; Brug, Glanz and Kok (1997) and increasing fruit and vegetables (Laforge, Greene, and Prochaska, 1994; Brug *et al*, 1997; Campbell, Symons, Demark-Wahnefried, Bernhardt, McClelland and Washington, 1998; Campbell, Reynolds, Havas, Curry, Bishop, Nicklas, Palombo, Buller, Feldman, Topor, Johnson, Beresford, Motsinger, Morrill and Heimendinger, 1999). Most of these studies have involved either simple descriptions of the stage distribution in various samples, or looking at associations between stage and other psychological components of the model in cross sectional studies.

Laforge et al (1994) looked at psychosocial factors associated with fruit and vegetable consumption. Intention to eat 5 or more servings of fruit and vegetables was assessed in 407 adults. The majority of participants were in the *precontemplation* or *contemplation* stages of change with only a small minority in the latter stages of change. Fruit and vegetable intake varied across with stages of change with maintainers eating more than precontemplators. Gender and education were found to be strong predictors of stages of change, with men and those with lower levels of education being likely to be in the *precontemplation* stages of change. de Graaf, Van-der-Gaag, Kafatos, Lennernas and Kearney (1997) investigated stages of change for eating more healthily among 14,331 adults in 15 European countries. Healthy eating was defined as eating less fat, more vegetables and a balanced and varied diet. The majority of participants were either in the *precontemplation* (52%) or the *maintenance* stage (31%). However there was variation by country in the proportions in each stages of change. For example in Finland 20% were in the *precontemplation* stage compared to 64% in Portugal. Participants in the *maintenance* stage were found to think more about the nutritional aspects of food and more frequently looked for information on healthy eating than those in the *precontemplation* stage. The stages of change was also useful in distinguishing between people with different attitudes towards nutrition and health.

There is considerable variation in the stage distributions depending on the type of dietary behaviour being studied and also between studies (See Table 1). The proportion of people in each stage is likely to be dependent on the measures and samples used. The variety in proportions in each of the stages of change in individual studies support this studied. Glanz et al (1994) found that almost half of participants were in the action stage for reducing fat, which compare to only 6% of men in Curry et al's study (1992). The work on fruit and vegetable intake using stages of change shows a similar degree of variability with Laforge et (1994) finding the majority of participants were either precontemplators or contemplators whilst Brug et al (1997) found the majority of participants were with decision makers or maintainers. This could be as a result of differences in the measures used, the sample or complexities associated with classifying different aspects of diet.

Table 1 Stage distributions for dietary behaviour studies

	Sample	Precontemplation	Contemplation	Preparation	Action	Maintenance
Fat						
Curry *et al* (1992)	1083 adults	17 women	6	11	8	59
	(worksite and community)	29 men	7	7	6	50
Glanz et al (1994)	17121 worksite employees	14	19	4	46	17
Rossi *et al* (1994)	412 non smokers	20	16	8	21	35
Brug et al (1996)	507 employees	14	8	26	12	40
Fibre						
Glanz et al (1994)	17121 employees	12	28	9	33	18
Fruit and vegetables						
Laforge *et al* (1994)	405 adults RDD	38	29	19	2	13
Fruit						
Brug *et al* (1997)	739 volunteers	9	8	36	5	40
Vegetables						
Brug *et al* (1997)	739 volunteers	6	8	33	5	48

The other type of studies which use stages of change look at predicting the other aspects of the TTM incorporating processes, decisional balance, self-efficacy and stages of change. Brug et al (1997) looked at whether dietary intake, self-efficacy and attitudes differs across the stages of change for fruit and vegetables. Participants were categorised according to present intake levels and intentions and attempts to change intake. Using their classification method only a small minority were in the *precontemplation* (9%), *contemplation* (8%) and *action* stages (5%) with most people classified as in *preparation* (35%) or *maintenance* (43%). Participants in the *action* stage consumed the most with those in the *precontemplation* consuming fewest servings of fruit and vegetables. *Precontemplators* scored lowest on attitudes, self-efficacy and comparison to others. Whilst those in the *action* and *maintenance* stage score highest on the self-efficacy measure and the comparison measure. The authors suggest that nutrition education should be tailored to stages of change with participants in the *precontemplation* stage being given information to influence attitudes, whilst self-efficacy advice to increase confidence is given to those in the *contemplation* and *preparation* stages.

Campbell et al (1998) looked at stages of change and psychosocial correlates of fruit and vegetable consumption in a sample of 3,557 adult church members. In this study the staging algorithm specified consuming 5 servings of fruit and vegetables a day as the intended behaviour. The majority of participants were in the *preparation* (65%) or *precontemplation* (24%) stage. Both self-efficacy and beliefs about recommended intake were associated with stages of change, however perceived benefits were not found to be associated with specific stages. Participants in the latter stages of change tended to have higher levels of self-efficacy whilst those in the precontemplation and contemplation stage believed the number of servings needed was less than other groups. The authors conclude that the stages of change model is applicable in this diverse sample and that differences in psychosocial factors support using stage matched interventions for change. Although there appear to be differences in psychological factors by stages of change, there is no definitive pattern to tell us which factors are more prevalent in which stage. Indications suggest that higher levels of self-efficacy are associated with people who have already made change, however the strong established association between self-efficacy and behaviour may be the cause of this. There is a tendency for research studies to combine several stages of change to explain these differences in psychological factors. What is evident is that there is not a linear association between psychological variable and stages of change, but for one stages group to generally score higher than other groups overall.

Staging Algorithms

Stages of change can be classified using a number of different techniques, however in the dietary field an algorithm method is the most favoured. This method relies on participants answering a set of questions, which, depending on the answers, lead to them being placed in one or another stages of change. The algorithms were originally developed from the work by Prochaska & DiClemente (1986) for smoking behaviour, although they have changed somewhat over the years. There is no, one, validated and reliable algorithm which is used universally. Rossi, Greene, Reed, Prochaska, Velicer and Rossi J (1993) compared 4 stages of change algorithms for dietary fat reduction. They found that most of the algorithms classified people whose fat consumption was higher than recommended levels, as maintainers. Therefore if this information was used for intervention studies it would mean that people may be excluded because of their stage, when their intake level was still less than recommended or that people were given the wrong messages about behaviour change. Lechner, Brug, De Vries and van Assema (1998) used two methods of classification to look at stages of change for fat, fruit and vegetables intake. They found that the traditional method based on self-rated intake and future intentions showed different results, from the alternative method which took account of estimated consumption levels. Lechner *et al* (1998) noted that people's awareness of their present dietary behaviour is an important issue since many people were unaware that they ate too little or too much of a particular food type. In this respect classification for diet is very different from classification for smoking. There may be similar problems in applying the system to exercise in that many people can be unaware that their level of activity is below what is recommended. In the exercise field Richards Reed, Velicer, Prochaska, Rossi and Marcus (1998) found that different algorithms produced very different distributions of stages of change.

One important issue is to ensure that the behaviours which people are questioned about are sufficiently clearly specified to allow them to make the appropriate response. For example asking participants about intention to do 'more exercise' or to do 'exercise daily' are likely to elicit different responses. It is evident from the literature that slight variations in the algorithms used may be in part responsible of the variation in staging.

One issue that is constant in all the algorithms is the arbitrary time periods used for classification. These have been replicated from the early work done by Prochaska & DiClemente (1982) with no scientific basis. Therefore when using algorithms it may be useful to attempt to quantify and validate scales used.

Special problems with classifying diet

There are several issues that arise when using the stages model to classify individual's dietary behaviour. In the smoking field it is relatively easy to classify participants because they either smoke or do not smoke. However dietary behaviour is much more complex and changeable. First people are not necessarily aware of appropriate targets. For example in fruit and vegetable studies individuals may not be aware of what constitutes five servings a day, so clear illustrations of servings are important, or in fat studies, what constitutes a low fat diet. Self-reporting relies mainly on subjective ratings of behaviour. Although self-ratings of intake have been shown to be reliable, they are subject to constant change due to environmental, social and personal factors.

Secondly the work on smokers and those receiving psychotherapy, were developed on individuals who were not representative of the general population. Thus only people who had an 'identifiable problem' took part in studies. In dietary studies it is much more difficult to exclude people who appear to be eating an appropriate diet, especially because of the reliance on perceived intake levels. This means that the sample is likely to contain people who are already doing the target behaviour, having never made changes to their behaviour in the past. This would be equivalent to never-smokers being staged as pre-contemplators (never thought of giving up). The time periods used to differentiate people for staging are based on the smoking work and therefore might not be appropriate for dietary change behaviour, where less specific times may be needed. Povey, Conner, Sparks, James and Shepherd (1999) looked at stages of change for three dietary behaviours (healthy eating, eating a low-fat diet, and eating 5 servings of fruit and vegetables a day). The vast majority of participants in the action stage for healthy eating had been trying to change for over 6 months (82%), and could be construed as maintainers.

Finally, when categorising individuals, there are likely to be people who have made changes in the past who may be classified as maintainers because of traditional algorithms but who may not have made sufficient changes to achieving the target behaviour. Therefore decisions need to be made about the important characteristics of each stage. This is especially prudent if this theoretical model is used in intervention studies.

Staging for interventions

This leads us onto the real value of the staging application, which has been hypothesised to be the opportunity to match the intervention strategy to the client's readiness to change their behaviour. In some cases this may mean selecting participants for a programme, in others selecting the kind of programme each participant should receive. Recently it has been widely used in the development of 'stage-matched' or 'tailored' interventions (Prochaska & DiClemente, 1993; Campbell, DeVellis B., Strecher, Ammerman, DeVellis R. and Sandler 1994; ; Brug, Steenhuis, van Assema and de Vries, 1996). Therefore stage interventions involve giving individuals different types of information dependent on their stages of change. For example those in the decision making stage would be given information relevant to increasing the perceived benefits of change. The opportunity that arises out of staging is that people can be broadly categorised for interventions taking account of a whole host of psychological determinants relevant to their readiness to change their behaviour.

Chapter 2 Introduction 2 - Behavioural Change

Health behaviour interventions

Introduction

This chapter aims to discuss the different types of interventions that have been used within the context of health behaviour change, the role of theoretical models in intervention design and the samples that participate in such interventions. Additionally the different methods of designing interventions, taking account of content issues will be examined. Relevant studies will be discussed in order to illustrate each of these issues.

Health interventions have occurred as a consequence of the emergence of public health messages, specifically about cancer and heart disease. It has been suggested that preventative behaviour for disease mortality is more cost effective than treatment of disease (Williams & Wynder, 1993). Prevention works through changing health behaviours which can have a direct impact on the onset of diseases such as smoking, cancer screening and dietary behaviour. Health education intervention studies attempt to educate individuals and persuade them to make changes to their behaviour, using a variety of different techniques. Consequently there is a great interest in developing new interventions and evaluating their effectiveness and efficiency.

Intervention type

The many different types of intervention used for health behaviours have had various levels of success. The types of intervention include printed material such as leaflet, posters, reports and letters; mass media campaigns which, include newspaper, television and radio, material; group work including demonstrations, educational classes and focus groups, or individual care using one-to-one counselling.

Mass media campaigns are one method of administering interventions to large numbers of people. They are often targeted at certain communities with large populations (Puska, Nissinen, Tuomilehto, Salonen, Koskela, McAlister, Kottke, Maccoby and Farquhar, 1985; Farquhar, Fortmann, Flora, Taylor, Haskell, Williams, Maccoby, and Wood, 1995). Most of these types of intervention studies have been carried out in the US and more recently in Australia. Many different media are used to give information including television, radio, the internet, magazines and newspapers. The principle benefit of mass media campaigns is the ability to target larger samples of participants in programs, so although the initial cost may be high, the audience reach is also very wide. However these programmes sometimes do not target those people those people most in need of change (lower SES or ethnic minorities), and the impact is less for certain groups (Gaziano, 1983). Often, mass media campaigns are supported by smaller more intensive programmes to change behaviours. Some of the behaviours that have been targeted include smoking cessation (Mudde and DeVries, 1999), health screening (Jenkins, McPhee, Bird, Pham, Nguyen, Nguyen, Lai, Wong and Davis, 1999), exercise participation (Marcus, Owen, Forsyth, Cavill, and Fridingeret, 1998) and dietary change (Foerster, Kizer, Disogra, Bal, Krieg and Bunch, 1995). Due to the size of these programs, it is can be difficult to have a comparison or control group to determine intervention effect. Contento (1992) suggests that mass media campaigns are good for raising awareness and improving knowledge but behaviour change can only be achieved if the behaviour is highly targeted and messages are carefully focused.

The use of printed materials is one of the most popular intervention methods used to target groups of individuals. Individuals or groups of participants are sent a leaflet giving them advice, information, and often making recommendations to change behaviour. These are often distributed using mailing lists which determine the sample for participation. The information sometimes targets factors already discussed earlier such as barriers, knowledge and self-efficacy. Most printed materials involve giving the same information to everybody. Thus widely accepted barriers will be dealt with by giving solutions or resolutions to change. The efficacy of this form of information giving, largely relies on a salient and active audience. The advantages of this method of intervention are that large numbers of people can participate in the programme at relatively little cost per person. However there is comparatively little control over the sample so checks need to be carried out to ensure that the intervention has been received and read.

Other interventions depend on more intensive work such as focus groups, educational classes or one to one advice. This means that more personal issues can be dealt with at one time. Sometimes these sessions can also be interactive, allowing people to participate in activities. More often than not these more intensive types of intervention are used for people who are at greater risk. These are especially popular when targeting people in smoking cessation programmes where people may have difficulties in trying to give up. Lillington, Royce, Novak, Ruvalcaba and Chlebowski (1995) and Lowe, Balanda and Clare (1998) have used one-to-one counselling to encourage pregnant women to give up smoking and found that there were significant improvement in abstinence rates. The benefits of this type of intervention are that there is greater control over participants in the intervention program and interventions can be more intensive. However as a result they take longer to administer, they tend to be vastly more expensive per participant. Therefore cost effectiveness analysis may need to justify the additional cost of intensive interventions.

The type of intervention used is often dependent on the target sample. Some forms of intervention are better suited for larger audiences such as mass media whilst one to one care may be better suited to groups with special needs. There are several issues which may determine which method is used in the end such as level of intensity, control over participants, number of participants and intervention effect size.

Setting

There are a variety of different places where interventions can be conducted. Places such as work sites, schools, community settings, primary care settings and medical settings are just some of the settings which are widely used. It is important to ascertain whether the sample is homogeneous or heterogeneous.

Community settings

Community settings are one setting where an entire population is targeted rather than a specific group. These can be selected for ease of comparison or geographic location. They also can mean a variety of different groups of participants. The advantages of using community settings are that large groups of people can be given an intervention at the same time. These settings have been used to good advantage especially in the US and Finland. Reduction of heart disease has been one of the major outcomes addressed in large scale intervention studies. Four studies in particular have attempted to alter risk factors for heart disease in a community population over the long-term. These were the North Karelia Project (Puska, Nissinen, Tuomilehto, Salonen, Koskela, McAlister, Kottke, Maccoby and Farquhar, 1985), the Pawtucket Heart Health Program (Carleton, Lasater, Assaf, Feldman and McKinlay, 1995), the Minnesota Heart Health program (Luepker, Murray, Jacobs, Mittelmark, Bracht, Carlaw, Crow, Elmer, Finnegan and

Folsom, 1994) and the Stanford Five City Project (Fortmann, Flora, J.A., Winkleby, M. A., Schooler, C., Taylor, C. B., and Farquhar, 1995) which was preceded by the Stanford Three Community Study (Farquar, Maccoby, Wood, Alexander, Breitrose, Brown, Haskell, McAlister, Meyer, Nash and Stern, 1977). These large scale interventions targeted participants at many of the settings already mentioned by using existing service structures and community organisations.

The North Karelia Project (Puska et al, 1985) was set up between 1972 and 1977 to tackle the high rates of heart disease in Finland. It was a program aimed at reducing risk factors such as smoking behaviour, high blood pressures and high serum cholesterol levels. Thus smoking, salt intake and saturated fat intake were addressed in a programme diverted towards adults with a special focus on middle-aged men. Participants in the intervention (North Karelia population 180,000) were characteristically had low socio-economic status with high unemployment rates due to the economic climate of the area. The intervention involved media and educational activities (e.g. working with newspapers and radio, and production of education material), training of key personnel (e.g. doctors, nurses, teachers etc.) for dissemination of information, reorganisation of health service provision (e.g. hypertension clinics), and community activities (e.g. support groups and food service providers). Evaluation of the project was carried out with cross sectional surveys in 1972 (n=8,241), 1977 (n=8,999) and 1982 (n=4,623) on people from North Karelia who were compared with a control group in Kuopio, another county in West Finland. Smoking behaviour, serum cholesterol level, systolic and diastolic blood pressure levels and coronary mortality were assessed. There were significant decreases in smoking and mean serum cholesterol level in men, and also reductions in systolic blood pressure in the first five years and diastolic blood pressure in the ten year period, for men and women. There were also decreases in mortality from coronary heart disease and cardiovascular disease in North Karelia compared to the rest of Finland. As the intervention was focused on men, the differential changes between men and women were not surprising. Dietary changes were assessed by measuring amount and type of milk and spreading fat used. The results from this study were very encouraging for this type of study. However the sample of participants was quite specific with regards socio-economic status so results may not necessarily be generalisable to other populations.

Another study which was being carried out in the US at the same time was the Stanford Three Community Study (Farquar, Maccoby, Wood, Alexander, Breitrose, Brown, Haskell, McAllister, Meyer, Nash and Stern, 1977). This began in 1972 in three towns in Northern California (sample approximately 45,000) using health education to reduce the risk of cardiovascular disease. Two of these towns were subjected to a mass media campaign whilst the third acted as a control. Cross sectional surveys of participants (approx 1200) were assessed at baseline and at 1 and 2 year follow-ups for changes to knowledge of risk factors, saturated fat intake, cigarettes smoked, plasma cholesterol level, systolic blood pressure and relative weight. There were found to be significantly greater reductions in dietary cholesterol consumption and saturated fat in the treatment groups, whilst the control group showed greater increases in plasma cholesterol level and relative weight. The intervention groups significantly reduced their risk of coronary heart disease from baseline.

As a consequence of the encouraging results from this study, a longer community study was started, called the Stanford Five-City Project (Fortmann et al, 1995). This study consisted of a 6 year education programme which addressed risk factors for coronary heart disease. The focus of the intervention was on improving nutritional status of participants using TV programs, nutrition booklets, seminars and workshops. There were 2 treatment cities (population 122,800), 2 control cities (population 197,500) and 1 surveillance city (used to assess comparable coronary mortality and morbidity). The baseline assessment was carried out in 1978 with the intervention programme running from 1980-1986. Cross sectional surveys (n=1,250 approx) and cohort surveys (approx 39% of 1,250) showed there were no changes to plasma cholesterol, saturated fat intake or dietary cholesterol. The only positive effect in the treatment group was that women had better nutritional knowledge. This program was expensive to sustain and results do not really justify the cost. The authors conclude that although there were modest reductions in risk factors in the intervention group, independent emphasis on risk reduction in the control groups meant it was difficult to ascertain the true effect of the intervention (Fortmann et al, 1995).

Another large scale study conducted around that time was the Minnesota Heart Health Program (Luepker et al, 1994). This again focused on reducing risk factors for coronary heart disease in 6 communities in mid West America. Three pairs of communities (intervention and control) took part in this ten year programme. Several components made up the intervention which included; a mass media campaign, physician education, risk factor screening, adult education, environmental programs and youth education. The outcome measures were BMI, smoking behaviour, cholesterol level, diastolic and systolic blood pressure. Cross sectional surveys and cohort surveys found there were no major physiological effects in the intervention group compared to the control groups although there were changes in risk factors for both groups. The authors suggest that comparison group coincidentally received exposure to risk reduction activities by the Department of Health which may have contaminated the results.

The third major intervention programme to be funded by the National Heart, Lung and Blood Institute was the Pawtucket Heart Health Program which ran from 1981-1993 (Carleton, Lasater, Assaf, Feldman and McKinlay, 1995). Participants derived from Pawtucket in North East America who received an intervention from 1984-1991 and a comparison city (n= 169,682). The target behaviours which were tackled were blood pressure, cigarette smoking, blood cholesterol, obesity and physical inactivity. Unlike the other community intervention studies mentioned this study did not use broadcast media as an aspect of the intervention, but targeted community organisations (e.g. schools) and service providers (e.g. grocery stores and gyms). Altogether 15,261 people were surveyed over the 12 years at 2 year intervals. No differences were found between the intervention city and the comparison city on the outcome measures apart from BMI. Again the authors suggest that this may be due to emphasis on risk reduction naturally occurring during the same time in the comparison city.

The results from these large scale intervention programs are not very encouraging. All were expensive, long term interventions which showed little effect on the physiological outcome measures. The latter ones also did not include measurement of dietary changes so there is no information on the effect of these interventions on general dietary behaviour. The two earlier studies showed some encouraging results with reductions in risk factors in the intervention group when compared to a control group. At the time, these health educational messages were relatively new and obviously became influential in the public health messages that followed. It may be that in the later studies, the intervention cities and communities were missing out on the normal standard of health education being promoted elsewhere. Therefore these communities were not receiving additional information but alternative information to other communities. There has been a suggestion that for campaigns such as these to be effective, they need to sustain a more intensive level for a longer time but this is reliant on community and organisational support. Per person, the costs of this type of community intervention are relatively low due to the target audience size. In spite of this the overall cost of setting up and running these projects is enormous and can only be carried out with major funding.

Worksite

Work sites are one setting in which to gain access to adults. The sample can be restricted in relation to gender, age and social class due to the nature to the work so caution needs to be taken when interpreting such results. The benefits of the work setting are that there is a fairly compliant sample and that additional support or resources can be provided by the organisation. On the down side, the sample is likely to be unrepresentative of socio-economic status, and intervention effects may only be present at the worksite. Worksites have been used as a setting to carry out interventions for reducing cardiovascular risk (Gomel, Oldenburg, Simpson, and Owen, 1993) and also adopting healthy diets (Patterson, Kristal, Glanz, McLerran, Hebert, Heimendinger, Linnan, Probart and Chamberlain, 1997). Gomel, Oldenburg, Simpson and Owen (1993) looked at the effectiveness of four interventions for reducing cardiovascular risk. There were four different interventions; health risk assessment, risk factor education, behavioural counselling and behavioural counselling plus incentives. Participants in the intervention were 431 employees from 28 ambulance service stations in New South Wales. Each of the stations was randomly allocated to one of the intervention programmes. The risk factors addressed were BMI, serum cholesterol level, cigarette smoking, blood pressure and aerobic exercise. This study was conducted to test the efficacy of worksites as a setting for administering public-health interventions. The results showed that the behavioural counselling interventions had a better impact than the other intervention conditions on changes to and smoking cessation at 3 months and BMI and percentage of body fat at 12 months. Whilst the behavioural approaches had some lasting effect on some of the cardiovascular risk factors, the majority of factors showed no change over time. Work sites offer the opportunity to routinely address these factors which could have a lasting public health impact, although little is known about the long term outcomes. The lack of a control group means that natural changes in these factors could not be compared.

The Working Well Trial (Patterson, Kristal, Glanz, McLerran, Hebert, Heimendinger, Linnan, Probart and Chamberlain, 1997) was a randomised worksite trial of 114 worksites lasting for 5 years across 16 states in the US. The aim of the study was to implement health promotion interventions to reduce the risk of cancer. Dietary behaviours targeted were fat, fibre and fruit and vegetable consumption. Some of the intervention techniques they used included contests, classes kick-offs and printed materials. Cross sectional surveys of approximately 9000 participants were done at baseline and follow-up. They found that there were significant increases in fruit, vegetable and fibre intake associated with the more interactive intervention elements. Fat intake decreased marginally, although analysis does not investigate what intervention elements contributed to this. One problem they identify in using this type of sample is that the results may not be replicable in the general population or at other worksites.

Both of these studies showed that intervention programs focusing on a various factors can be implemented within the work setting with some good effects. The more intensive elements of the intervention programs had the greater effects on behaviour. This suggests that people need additional support at the workplace to make behavioural changes.

Schools

Schools are another setting in which to administer interventions targeted at children. This is especially important for interventions which can be used to establish good dietary behaviours early on. Interventions that are carried out in schools have a receptive audience as they can be built into the educational programme already established. Particularly with young children, development of interventions and assessment procedures takes a long time. Care needs to be taken to ensure that tools used are relevant to the age of sample. This can mean that development of such tools is expensive because of the excessive piloting required.

Resnicow, Cross, Lacosse and Nichols (1993) conducted an intervention program aimed at improving cardiovascular risk knowledge, attitudes and behaviour in elementary school children (n=1,166) and their parents (n=514) in 8 schools. The intervention program consisted of screening of risk factors in children aged between 6 and 11 years which was followed up by a results letter sent to parents with recommendations for change. Intervention participants were found to have better knowledge, attitudes and early detection of disease. As well as this there were dietary change to fat intake in children with a decrease in self reported intake of fat and also parents were more likely to have their blood cholesterol tested. This school-based project was implemented effectively with positive outcomes indicating that schools are a feasible setting in which to disseminate information not only to children but to their parents as well. However limitations in the study design may effect the generalisability of finding with high attrition rates, non-randomisation of experimental group and potential social desirability bias because of a focus on attitudes and knowledge.

Another large school based project was the child and adolescent trial for cardiovascular risk, CATCH (Perry, Stone, Parcel, Ellison, Nader, Webber and Luepker, 1990). This multi-factorial project was carried out in 56 schools and included elements on food service, physical education, classroom activity and home programs which ran for three years. The intervention aims were to improve dietary intake, exercise participation and reduce smoking activity. Dietary intake in particular was assessed by 24-hour recall at baseline and follow-up. Information given by 1,182 participants was used to assess for changes in total energy, dietary cholesterol and dietary fibre, and also nutrient makeup of energy. Intervention participants showed significant changes to energy intake and also the proportion of energy from total fat, saturated fat and protein compared to the control participants. The fact that this program addressed classroom, food provision and home environments may have contributed to the successful results. However it is important to know whether there was a lasting impact of the program after its implementation was finished.

Both of these studies reflect on the positive changes to certain health behaviours attributed as a consequence of the intervention. As with many interventions which target more than one type of behaviour, there were not changes in all behaviours measured. Thus for some health behaviours which may need to be targeted at an early age school based interventions seem to be a good option. Schools also offer the advantage of having other professionals to administer advice without imposing additional time on participants. Longer term studies are needed to know if these intervention effects are sustained beyond the experimental time period. Both of these studies worked with a family based element so it would be interesting to determine whether the 'at school' or 'at home' element had greater impact on behaviour.

The types of setting that have already been described do not necessarily target people who are most in need of change. People who are already interested or contemplating change are more likely to respond to such interventions. It is also likely that a proportion of participants is already performing the target behaviour being addressed. Therefore more salient settings might be a possible way of targeting people not performing health behaviours.

Primary care

Primary care settings have been used as one method of getting access to people. The majority of people in the UK are registered with a GP (ONS, 2000). They can be accessed using either primary care lists or recruiting participants attending general practices (though the latter will recruit a 'sicker' group). The benefit of using this setting is that it can ensure a more representative sample of participants than some of the other methods although this is dependent on geographic location of the clinic. Primary care settings are also useful because they can provide a good opportunity to give information about health behaviours, because health issues are likely to be salient. The down-sides include the fact that address lists are often out of date, and people attending for treatment may not be willing to accept advice about health factors which do not relate to their reason for attendance. General practice settings have been used to good advantage in two studies which looked at improving healthy behaviours to reduce risk factors for cardiovascular disease and cancer. The first study was conducted in 26 general practices across England (Family Heart Study Group, 1994). Practices were randomly allocated to control or intervention, with internal comparison carried out within intervention practices. Altogether 8472 men and women aged 40-59 (at risk) took part in the study, with 2984 being given the intervention consisting of a screening interview (90 minutes) supplemented by pamphlets on lifestyle factors relevant to heart disease such as smoking, diet and exercise. In the intervention group cigarette smoking was down by 4%, systolic and diastolic blood pressure reduced by 7mm and 3mm, accordingly and weight by 1 kg average. Although these indicate positive changes in cardiovascular risk factors, significance levels were not reported so the impact of the intervention can not necessarily be merited. The results indicate positive changes to some of the risk factors, but many questioned whether this justified the cost of using individual screening and treatment.

The other British primary care study was the OXCHECK study (ICRF OXCHECK Study Group, 1995) carried out in 5 urban general practices. Participants were randomised either to a health check (sample 2205) or control (sample 1916) who received the health check three years later. The health checks were performed by practice nurses who had already received prior training to develop their knowledge and skills. Patients who had high risk factors were then referred to their GP for further care. The outcome measures in this study were cholesterol, blood pressure, BMI, smoking behaviour and self-reported dietary, exercise and alcohol habits. The follow-up assessment was conducted after three years. The results indicate that there were significant differences between experimental groups for blood cholesterol, BMI and dietary intake. Intervention participants had significantly lower levels of cholesterol, BMI and consumed less full fat milk or used high fat butter or spreads. Both of these studies used extensive manpower and resources to carry out the interventions with positive results on risk factors addressed. However to carry out similar studies would require considerable support from the General Practice clinics taking part which would require appropriate core funding.

Wonderling, Langham, Buxton, Normand and McDermott (1996) conducted a cost-effective analysis on both these studies, and concluded that if changes could be maintained for 5 years in the Oxcheck study and 10 years in the British Family Heart study then the projects would be cost effective considering the manpower and time needed. As a setting for carrying out intervention on risk factors for disease, this offers the opportunity to offer care whilst participants are salient to the information being given. Long-term follow up would enable conclusions to be drawn about the effectiveness at reducing morbidity and mortality from cancer and heart disease. There were low drop out rates in both of these studies with attrition rates ranging from 13% to 18%, suggesting that this setting was good for continued participation in intervention programmes.

Dental practices

Another more specific medical setting which has been used for giving health behaviour information is dental clinics, which have been used as a setting for giving out advice on smoking cessation (Andrews, Severson, Lichtenstein, Gordon and Barckley, 1999) and cancer risk (Peterson and Rippey; 1992) in the US. Dental clinics offer the benefits of having a sample who are available whilst waiting for appointments thus there is an opportunity to give them information at a salient time and also may be more motivated about their health. However the types of people who attend for dental care may not necessarily be representative of the population.

Andrews, Severson, Lichtenstein, Gordon and Barckley (1999) conducted an intervention delivered by dental hygienists to reduce smokeless tobacco use. Hygienists were trained to conduct a variety of activities which included giving advice to quit related to oral health, written material on giving up and a motivational video. 75 dental practices took part in the intervention program (633 patients) which were randomised to usual care (n=25) or intervention (n=50). The intervention resulted in sustained quitting amongst intervention participants. Hygienists were able to carry out the intervention alongside their regular duties, with positive outcomes. The benefit of this study was that no additional manpower was needed to carry out the intervention, even though the intensity level was high. Another study by Peterson and Rippey (1992) looked at the feasibility of dental clinics as a setting for giving out information about cancer risk. A computer system was set up in clinics for patients to use whilst people were waiting at the clinics. Several topics could be selected on the computer which included general cancer information, information about diet and cancer, smoking and environmental risks to cancer. The computer log showed that the computer was used by at least three people a day and there seemed to be no problem with using the computer unsupervised. In both of these studies the feasibility of dental clinics as a setting for giving out health behaviour information was good. Further information is needed to know about the outcomes of such interventions on subsequent behaviour.

There are many different types of setting which are viable for conducting health behaviour interventions. Some of these have had much more success than others but all offer benefits and costs to using them. One of the main reasons for using particular settings is the viability of conducting good research that can be reproduced. Issues of poor response rates and attrition can be dealt with more effectively when there is much more control over a setting. However all of these settings are reliant on support of the organisations that run them. There is a necessity to get public health messages across to certain groups of people who are in most need of change. This means that more work needs to be carried out with participants differentiated by gender, socio-economic status and motivation levels.

Theoretical models

The majority of intervention studies carried out have been theory driven. There has been a development in the theoretical basis to interventions which combined theory from social psychology, cognitive psychology, social marketing and economics. Theories used for intervention studies differ from those used for predicting behaviours. The large community interventions often used a combination of Social Learning Theory (Rotter, 1954; Bandura, 1977), Diffusion of Innovations (Roger, 1987) and Communication-Behaviour Change approach (Gillespie, 1987) to name but a few.

Social learning theory developed from the clinical psychology work carried out done by Rotter (1954). This theory addresses the processes of learning through the expectations of a behaviour and the value of those expectations. 'A person both affects and is affected by their environment' (Contento, 1992). Perceived control is a important construct of this theory because it influences these expectations. Participants make change based on acquiring knowledge about the consequences and benefits of a behaviour.

Diffusion of Innovations Theory uses four stages which are knowledge, persuasion, decision and confirmation. People are classified on their 'innovativeness' (ability to act on information) and professionals may try to influence this process. The way this has been used in community intervention is through the use of mass media as a method of creating knowledge and interpersonal contact to change attitudes and behaviour. In a community there are likely to be key people (e.g. professional or social leaders) who will disseminate information and influence people, using a top down approach.

The Communication Behaviour Change approach uses the role of communication in behavioural change. This incorporate aspects form several different models such as the Social Learning Theory, the communication persuasion model (McGuire, 1969) and The Theory of Reasoned Action (Ajzen & Fishbein, 1980). The processes involved in change include; attention, motivation, comprehension, learning information, attitude change, skills performance and maintenance of skills. Thus communication is just one tool in disseminating information where the recipient have an active role in listening to, and acting on messages.

All of these models are particularly useful for campaigns which use mass media as a means of behaviour change, although some of the basic facets are useful in other types of intervention.

These models differ from those explained in Chapter 1 for predicting health behaviours, because they are based on factors that effect behavioural change. However they often incorporate aspects of the social cognition models such as self-efficacy and attitudes into the means of changing behaviour.

Intervention design

As well as the sample, method and theoretical basis, it is important to consider the way material is presented. There is however very little research which has looked at the impact of interventions in these terms.

Message framing is just one consideration. The research on message framing has mostly focused on effect of 'gain-framed' versus 'loss-framed' messages on behaviour. Gain messages are those which emphasis the positive outcomes of a behaviour and the benefits of performing the behaviour, whilst loss-framed messages focus on the negative factors or risks of not performing a behaviour. These ideas have developed from the work on prospect theory which suggests that people respond to messages differently depending on how messages are framed (Tversky & Kahneman, 1981). Gain messages are thought to work better in preventative behaviour (Rothman and Salovey, 1997), because they are more motivating than loss messages.

Banks, Salovey, Greener, Rothman, Moyer, Beauvais and Epel (1995) looked at the effect of message framing on mammography screening. Using a 2-group randomised design, participants were either shown a gain-framed or a loss-framed video. Participants were 133 women who were currently not adhering to recommendations about mammography attendance. The gain-framed video emphasised the benefits of having a mammography (e.g. if a cancer has not spread, it is less likely to be fatal) whilst the loss-framed video emphasised the risks of not having a mammography (e.g. if a cancer has spread, it is more likely to be fatal). Participants were followed up at 6 and 12 months to look at change in attendance for mammography, and knowledge. Significantly more women from the loss-framed video group attended for screening when demographic and psychological variables were taken into account. There were no differences in knowledge between the groups. It was concluded that for detection behaviours loss messages may be more effective in encouraging behaviour change. Both of the interventions were matched by content of factual information to attempt to ensure that other factors did not contribute to any effect. Another study by Detweiler, Bedell, Salovey, Pronin and Rothman (1999) looked at the impact of framing on intention to use, and use of, sunscreen in beach-goers. In this experiment the impact of gain messages and loss messages were compared in 217 beach-goers. Participants who read the gain-framed brochures were significantly more likely to request sunscreen, intend to repeatedly apply sunscreen while at the beach, and intend to use sunscreen with a sun protection factor of 15 or higher, compared with those who read either of the 2 loss-framed brochures. These two studies offer two different types of results. This may be dependent on the type of behaviour change desired. There are no studies which look at the effect of message framing on dietary behaviour but as dietary change is usually thought to be preventive, it is likely that gain-framed messaged might be the more useful.

Another issue which has recently been considered in terms of enhancing comprehension and recall of written information is the form of the presentation. Clark, AbuSabha, von Eye and Achterberg (1999) looked at the impact of variations in text and graphics on recall of nutrition brochures. They found that there were no differences over time between brochures using either abstract or concrete text or graphics. These results suggest that content is more important than the text used or graphics. However Pocinki (1991) suggests that graphics can be used to reinforce text especially in materials for older audiences. Whilst content is the most important issue to consider in designing intervention, the use of text and graphics can be used to enhance understanding in certain audiences.

Lastly other design issues which should be considered are the readability and salience of the information. Readability is often assessed using the Flesch Formula or Flesch Humans Interest Score (Flesch, 1948) which take account of the number of syllables and words in a text and also the percentage of personal words and sentences. Johnson, Mailloux and Fisher (1997) conducted a study to assess the readability of HIV education material. They found that 50% of the materials examined had higher readability levels than average. Due to the nature of people reading these materials, this would mean that a large proportion of them would not be able to comprehend the information given in the materials. Thus however good an intervention may be, if people can not comprehend the information in it then it is no use to them. This is especially important in materials aimed at children. Also it is important to consider the personal relevance of information to the individual. The more personally relevant the material is, the more likely that participants are to act on it. Calvert and Cocking (1992) found that people were more likely to act on television messages about healthy lifestyles if they perceived them as more personally relevant and felt that they could translate these messages into personal actions. Therefore it may be necessary to consider individual and personal factors when designing interventions for different samples. There has been very little research that has looked at the effect of these factors on the impact of interventions, especially in the dietary behaviour field. Thus it would be interesting to consider these factors not only in the design of interventions but also interpreting the impact of such interventions.

Summary

The conclusions to draw from the literature on public health based interventions are that there is a need to evaluate and test their effectiveness properly. As well as this the focus on general health messages needs to be narrowed to target those behaviours in those groups who are most in need of change. Public health interventions have become increasingly focused on dietary behaviours although there is lack of work on fruit and vegetable intake. Consideration needs to be given to the type of intervention used, the sample it is applied to, the theoretical models and methods used in its design.

Fruit and vegetable interventions

Evidence for the value of increasing fruit and vegetables in the diet has emerged relatively recently. Consequently, there are comparatively few dietary intervention studies that address intake of fruit and vegetables. Those intervention studies designed to specifically address fruit and vegetables have targeted different groups of the population such as schoolchildren, participants from work sites, shoppers in supermarkets, and community groups. The type and intensity of interventions used, have also varied with printed materials, telephone counselling, educational classes and one-to-one counselling to name but a few.

School based interventions

Domel, Baranowski T., Davis, Thompson, Leonard, Riley, Baranowski J., Dudovitz and Smyth (1993) used educational classes in schools to try to increase consumption of fruit and vegetables. Participants were 301 children aged between 10 and 11 in two schools. Children in one school comprised the intervention group, while another similar school was the control group. The intervention gave information on the '5 a day' message and ways of increasing intake, and used behavioural change methods based on social cognitive theory. The program lasted 5 weeks and involved a diverse team of professionals (dieticians, psychologists, teachers, and an epidemiologist). The program achieved changes in knowledge and preferences for fruit and vegetables as a snack, but there were no effects of the intervention on intake of either fruit or vegetables immediately after the intervention. These results are disappointing in terms of the intensive efforts and the number of experts required in its development and application, for so little effect.

Perry, Bishop, Taylor, Murray, Mays, Dudovitz, Smyth and Story (1998) used a similar intervention with the same aged children. This study was part of a larger national programme in the United States (the 5 a day program) aimed at increasing fruit and vegetable consumption in different population over some years (Havas, Heimendinger, Damron, Nicklas, Cowan, Beresford, Sorensen, Buller, Bishop, and Baranowski, 1995). Other studies in the programme will be discussed below in the context of their setting. This intervention used a combination of behavioural change techniques based on social learning theory, parental activity, changes to food provision at the school and support from industry. All of these aspects were designed to complement each other. Out of an initial sample of 1750 students from 20 schools, 557 students were randomly selected for dietary measurement with 441 students completing the baseline and follow-up measures. The programme was found to increase both fruit and vegetables at different times of the day. There was more effect on fruit than vegetable intake, and also greater changes in boys than girls. Participants were followed up after one year of the programme. One possible reason why this intervention study succeeded where the previous did not could be the ongoing community-level intervention running simultaneously, which meant that participants were being targeted at school and at home. This again was a multi-faceted intervention, which was very intensive in terms of the professional time and included support from many different backgrounds such as government, industry and educational.

A third large study (Reynolds, Raczynski, Binkley, Franklin, Duvall, Devane-Hart, Harrington, Caldwell, Jester, Bragg and Fouad, 1998) is using similar approaches to increase fruit and vegetable consumption. Initial results suggest enhancements in knowledge levels, but there are no results on intake available yet. These school-based studies often go beyond the school setting with additional components being carried out in the community.

Community-based interventions

Whilst there have been many large-scale community intervention studies which have addressed health behaviours, there are only a few directed towards fruit and vegetables intake.

Foerster, Kizer, Disogra, Bal, Kreig and Bunch (1995) conducted a large-scale study aimed at raising awareness of the benefits of fruit and vegetables and increasing intake. The study was a collaboration between industry and the Californian Department of Health Services. The intervention involved a mass-media campaign promoting the 5 a day message, which was supported by information provided at point of purchase in supermarkets. Two cross sectional survey of approximately 1000 adults of mixed ethnicity, age, gender and educational levels were conducted, one in 1989 (before the intervention) and 1991 (after the intervention), to examine population changes to intake, awareness, knowledge, attitudes and beliefs, although the samples were not linked. No significant changes in intake were found although more people were aware of the association between fruit and vegetables and cancer, and more thought they should eat more fruit and vegetables, but surprisingly, there was no change in the number of people who *thought* they should eat 5 servings a day. This appeared to be another example of influencing knowledge, without any impact on intake levels.

Brownson, Smith, Pratt, Mack, Jackson Thompson, Dean, Dabney and Wilkerson (1996) addressed fruit and vegetable consumption in the context of reducing cardiovascular disease factors in a community setting. Other health behaviours assessed were physical activity, smoking behaviour, weight and cholesterol screening. The intervention program consisted of a variety of activities aimed at addressing risk factors such as cooking demonstrations, disease education programs and screening. Cross sectional surveys of approximately 1000-1500 adults in the intervention region and 380-440 adults in the state-wide comparison region were conducted at baseline 1990 and follow-up 1994. There were improvements in utilisation of cholesterol screening in the intervention group but no other changes in behaviour. State-wide comparison showed that there was an increase in the number of adults consuming at least 5 servings of fruit and vegetables a day, even though there was no change in the intervention group (i.e. the reverse of the expected effect). The lack of change in dietary behaviour is not that surprising because the intervention was broadly based on cardiovascular risk.

These two large American studies showed poor results with regard fruit and vegetable intake which does not offer a very optimistic perspective on using community interventions for this type of dietary behaviour change.

Dixon, Borland, Segan, Stafford and Sindall (1998) conducted a large-scale, mass media intervention to encourage increased consumption of fruit and vegetables in Australia. In this study, a multilevel state-wide nutrition promotion campaign was conducted over three years, which combined industry and community-based initiatives. The main message of the study was '2 fruit and 5 vegetables a day', which is substantially more than the campaigns used in other Western countries. To assess the impact of the campaign, approximately 500 participants were asked to take part in a telephone survey about the intervention, the amount of fruit and vegetables they should be eating and the amount of fruit and vegetables they were eating. There was a significant increase not only in *beliefs* about the amount of fruit and vegetables people should eat but also in the amount of fruit and vegetable intake, between the first and second year. However there were no increases in the amount people believed they should eat or the amount they did eat over time, at 3 and 4 years on. One of the problems with this method of investigation is that there was no control group. Mass media campaigns seem useful in instigating change although maintaining change over time may need more personal interventions.

Whilst community interventions have the advantage of targeting large groups of people, it is difficult to keep track of these people in the long-term. Therefore assessments of outcome change tend to be done cross-sectionally where it is difficult to measure the impact of the interventions. The results of these community based interventions are not promising for fruit and vegetable intake. Without appropriate stratification of samples it is also difficult to ascertain whether these types of programme have an impact on those people most in need of change. The benefits of addressing large numbers of people need to be weighed up against the poor impact of the interventions on behaviour.

Food service provision

A few studies have addressed users of the food services industry. The methods and means of food provision can act as a barrier to both the consumption and buying of fruit and vegetables. Therefore working at the point of purchase seems like a good setting in which to target consumers. Two feasible settings for interventions are supermarkets and cafeterias. Rodgers, Kessler, Portnoy, Potosky, Patterson, Tenney, Thompson-, Krebs-Smith, Breen, Mathews, et al (1994) carried out an intervention in a supermarket setting to promote healthy food choices. 20 stores had labels positioned close to foodstuffs giving information about nutrients and also leaflets about nutrition were handed out, whilst 20 comparison stores had the normal nutrition information provided. Change was measured with computerised sales figures of total purchasing of fibre containing foods. After two years there were increases in market share of fresh produce, frozen and canned vegetables in the intervention shops. However baseline differences in income and also population changes in the two year time period mean that the changes can not be attributed to the intervention only.

Another supermarket intervention was carried out by Kristal, Goldenhar, Muldoon and Morton (1995) to look at the effect of a point of purchase intervention. A two-group design was used with 8 supermarkets being randomised to an intervention or control group. The intervention condition, which was carried out for 8 months, consisted of flyers given out at supermarkets about fruit and vegetables with menu ideas, coupons and better signs in the store to identify foods, and demonstrations and signs aimed at raising awareness of fruit and vegetables. Participants were cross sections of shoppers who completed supermarket exit interviews and took home questionnaires to complete at baseline and approximately 1 year later after the intervention was initially implemented. Approximately 350 people completed both baseline and follow-up assessments in both intervention and control group. No significant impact of the intervention was found on self-reported fruit and vegetable purchases or fruit and vegetable consumption at follow-up. Whilst the authors suggest that the duration and intensity of the intervention may not have been sufficient to initiate a change, this does not account for the poor results.

Jeffery, French, Raether and Baxter (1994) looked at the impact of increasing the available choices of fruit and salads in a cafeteria. Purchases were observed for three weeks before and after the three-week intervention period. Both fruit and salad purchases were seen to increase during the intervention period. However although significantly higher immediately after the intervention, fruit and salad purchases decreased after the study. The intervention appears to have had an effect on purchasing although it is not clear which aspects contributed to this short term change. It is uncertain whether the changes both to variety and price would need to be maintained for behaviour to remain at an increased level.

None of these studies showed an increase in intake of fruit and vegetables although purchasing did increase in 2 of the 3 studies. However it is not clear whether changes in purchasing could be maintained after the end of the active intervention phase. More work is needed to assess the impact of point of purchase interventions on dietary behaviour.

Interventions provided at work

There are not many studies which have used work-sites to conduct dietary interventions. Sorensen, Stoddard, Peterson, Cohen, Hunt, Stein, Palombo and Lederman (1999) used a three-group design with a minimal intervention control group, a work-site intervention and a work-site plus family intervention. The work-sites used in this study were community health centres with a total sample at follow-up of 1305 participants. All three groups were exposed to the national 5 a day media campaign and promotion of the cancer information hot line as well as nutrition education and tasting at the work-site (minimal intervention). The work-site condition included elements to encourage individual changes in behaviour as well as changes at the work places e.g. more choices of fruit and vegetables, whilst the family intervention involved a learn at home program, a family newsletter and other mailed materials. Participants were followed up two years after the baseline measurement to assess for changes in fruit and vegetable intake. At follow-up there was a significant effect of the work-site plus family intervention in a three groups analysis with increases in combined fruit and vegetables ($p=0.05$). The results indicate that a work-site intervention only can have a beneficial effect on fruit and vegetables intake (7% increase) and that adding a family oriented component further adds to this effectiveness (19% increase). The sample used in this study were workers in community health clinics who are likely to have more knowledge about healthy dietary practices and may be more motivated to change behaviours than the normal population.

Buller, Morrill, Taren, Aickin, Sennott Miller, Buller, Larkey, Alatorre and Wentzel (1999) conducted a work-site intervention study using peer education amongst lower socio-economic employees to increase fruit and vegetable intake. 2091 employees received an 18 month intervention program which involved peer educators communicating to other members. There were found to be significant increases in total fruit and vegetable intake at 1 month and 5 month follow-ups. The results indicate that changes can be made to participants from lower socio-economic groups within a work site setting, although the study did not focus on the entire work structure. Therefore how this would fit into management structure is not known.

Both of these studies showed increases to fruit and vegetables as a result of intervention given at worksites. The indications are that worksites offer a feasible setting in which to carry out interventions aimed at fruit and vegetable intake, however some form of personal contact is required (e.g. family or peers). Work site interventions offer the opportunity for targeting people without imposing on their personal time and also retaining them in studies. There may be methodological problems with obtaining representative samples (e.g. lack of low SES or women) and also organisational issues to do with cost effectiveness to employers.

All of the settings illustrated have been carried out in either the US or Australia so it is not known whether they are replicable in the UK with different populations.

British fruit and vegetable interventions

There are very few published studies that have looked specifically at increasing fruit and vegetable in the UK. Cox, Anderson, Reynolds, McKellar, Lean, and Mela (1998) looked at the impact of a nutrition education intervention on consumer choice and nutrient intake. Participants were recruited using a market research agency in England and Scotland. They were included in the sample if they were i) not vegetarian, ii) consuming at least 1 serving but less than 5 servings of fruit and vegetables a day and iii) were contemplating change as measured by the Stage of Change Model. No information is given about the number of people initially asked to participate. Participants were asked to complete a questionnaire and at a later stage invited to take part in the intervention. Using a three-group randomised design, 170 participants were allocated to two intervention groups or a control group. The intervention groups attended a nutrition education session with a combination of educational, motivational and behavioural approaches and also a self-monitoring section over the 8-week intervention period. Particular attention was paid to teaching about the association between intake and disease (e.g. cancer), the practicalities of increasing intake and definitions of serving sizes. There were significant increases in weighed intake of fruit and vegetables at 8 weeks although they had diminished somewhat at 5 and 12 months. Anderson, Cox, McKellar, Reynolds, Lean, and Mela (1998) looked at the impact of the same intervention on attitudes to changing fruit and vegetables in the same sample (104 useable questionnaires). Participants were followed up to assess changes in intake, beliefs about fruit and vegetables and additionally intervention participants were asked about perceived and actual barriers. Beliefs about fruit and vegetables were evaluated with questions about beliefs relating to health, vitamins, cost, taste and preparation and also about outcome evaluation e.g. choosing foods good for overall health. Barriers covered were situational barriers such as difficulties of eating away from home and perceived practical opportunities to eat fruit and vegetables. There was an increase in situational barriers, and reduction in beliefs about social support. Therefore as a result of the intervention, attitude factors became more negative although behaviour increased in the same period. The conclusions drawn were that fruit and vegetable intake can be increased but more awareness is needed about the situational barriers and social support.

Although there were changes in intake levels of fruit and vegetables, issues to do with sampling mean that the results are not generalisable. The sample was selective because they were mainly women and also contemplating change which means they may be more likely to make changes to their behaviour.

Summary

On balance the evidence for changing fruit and vegetable intake using interventions which are the same for everybody is not very strong. The changes that have been shown are small, if there are any at all and these have not been shown to be applicable to large groups of the population. More understanding is needed to understand the reasons why increasing fruit and vegetables are so difficult. ‘General interventions’, which are the same for all participants, are clearly not the best method for this type of behavioural change. It is evident that more intervention studies are needed which focus specifically on only fruit and vegetables.

Table 1 Fruit and vegetable interventions

Study	Sample	Setting	Intervention	Assessment groups	Outcome
Domel et al (1993)	346 school children	School	Educational classes	Intervention school Control school	↑ fruit, ↔ vegetables
Perry et al (1998	441 school children	School	Educational classes, food service changes and parent support	10 intervention schools 10 control schools	↑ fruit and vegetables
Reynolds et al (1999)	1698 families	School	Educational classes, food service changes and parent support	14 intervention schools 14 control schools	No results as yet
Foerster et al (1995)	1000 adults	Community	Mass media campaign	Intervention community	↔ fruit or vegetables
Brownson et al (1996)	1006-1510 adults	Community	Educational classes, media and demonstrations	Intervention community State-wide comparison	↔ fruit or vegetables
Dixon et al (1998)	500 adults	Community	Mass media campaign	Intervention community	↑ fruit, ↑ vegetables for first 2 years of project only.
Rodgers et al (1994)	40 supermarkets	Food service provision	Labelling and leaflets	20 intervention stores 20 control stores	Marginal ↑ in sales.

Table 1 continued

Kristal et al (1995)	350 supermarkets shoppers	Food service provision	Leaflets, signage and demonstrations	4 intervention stores 4 control stores	↔ fruit or vegetable purchases or intake
Jeffery et al (1994)	321 canteen customers	Food service provision	Increasing choice and economic incentives	Intervention group	↑ fruit and salad purchases
Sorensen et al (1999)	1306 employees	Work site	Media campaigns, demonstrations and environmental change	7 control worksites 7 worksite intervention 7 worksite + family intervention	↑ fruit and vegetables
Buller et al (1999)	2091 employees	Work site	Peer education	Worksite Control	↑ fruit and vegetables
Cox et al (1998)	125 general public	General public	Nutrition education session and printed material	2 intervention groups 1 control group	↑fruit and vegetables

Tailored interventions

In recent years, as an alternative to generic interventions, tailored interventions have become an increasingly popular method of attempting to change health behaviours. These have been used with a variety of health behaviours including breast screening attendance (Skinner, Strecher and Hospers, 1994; Rakowski, Ehrich, Goldstein, Rimer, Pearlman, Clark, Velicer and Woolverton, 1998;) smoking cessation (Prochaska & DiClemente, 1993; Strecher, Kreuter, Den-Boer, Kobrin, Hospers, and Skinner, 1994; Dijkstra, De Vries and Roijackers, 1998; Aveyard, Cheng, Almond, Sherratt, Lancashire, Lawrence, Griffin, and Evans, 1999; Velicer, Prochaska, Fava, Laforge and Rossi, 1999), HIV-Aids risk reduction, (Kalichman, Kelly, Hunter, Murphy and Tyler, 1993; McCoy, McCoy and Lei, 1998), physical activity (Marcus, Owen, Forsyth, Cavill and Fridinger, 1998) and dietary behaviours (Campbell et al, 1994; Brug, et al, 1996; Brug, Glanz, van Assema, Kok and van Breukelen 1998; Brug, Steenhuis, van Assema, Glanz and de Vries 1999a; Marcus, Heimendinger, Wolfe, Rimer, Morra, Cox, Lang, Stengle, Van Herle, Wagner, Fairclough and Hamilton, 1998).

Tailored interventions consist of giving participants information matched in various ways to the demographic, behavioural or attitudinal characteristics of the individual. These are thought to be more effective in initiating behaviour change than population-wide interventions because they are more salient to the individual and they can be more persuasive through tackling relevant motives and barriers (Brug, Campbell and Van Assema, 1999b). Many tailored interventions are also individually personalised, with emphasis being put on the individual's name or their membership of a certain group.

Methods of tailoring

Interventions can be tailored by a variety of different characteristics such as demographics (e.g. gender and ethnicity) or psychological variables (e.g. perceived risk, attitudes, self-efficacy or stages of change).

Demographic characteristics

Kalichman et al (1993) used the personal characteristics of gender and ethnicity to tailor messages about HIV-AIDS risk reduction. In their study they used video tapes about the prevention of immuno-deficiency syndrome which were shown to low-income, black American women (n=105). These women were recruited at community centres as a result of announcements being made about provision of education classes. Participants were randomly allocated to one of three conditions. Condition one used a video, which was based on a standard public health message. The standard public health message covered a description of HIV, the disease process of HIV, risks through sexual behaviour and common myths which were presented by white men and women. The second condition used a video in which the presenter was matched to the gender and ethnicity of the viewers; and, in the third condition, the video was framed to stress culturally relevant values. Knowledge of, and attitudes to, AIDS were assessed immediately before and after the videos, and two weeks later changes in behaviour were assessed. There were no differences between groups in knowledge or attitudes to AIDS at follow up, but participants in the culturally sensitive group were more likely to perform behaviours relevant to preventing AIDS such as utilising screening and requesting condoms. The study showed interesting changes in behaviour purposed to be as a result of the video, but as none of the hypothesised mediating variable were influenced by the intervention it is difficult to ascertain which aspects of the video had the impact on behaviour. The authors conclude that their approach may be useful for targeting larger community groups, and highlight the need for interventions to be sensitive to personal characteristics and values.

Beliefs and expectations

Another method involves tailoring interventions to psychological characteristics of the individual collected at baseline, with the most popular psychological variables being attitudes and self-efficacy. Dijkstra et al (1998) used a four-group design to look at the effect of tailored feedback on smoking cessation. Participants for this study were recruited through newspapers inviting them to take part in brief smoking cessation programmes. The four experimental conditions were tailored reports, focusing on quitting outcomes, enhancing self-efficacy or both, and a control group receiving no intervention. The interventions were tailored to the individual's intention to quit, perceived outcomes of quitting, self-efficacy and present behaviour, and consisted of a computerised report between four and seven pages long. Personalization was achieved by repetition of the individual's name throughout the materials. At fourteen months, smoking behaviour was assessed, and participants were asked to evaluate the experience of the intervention and also asked about the benefits, costs and skills, of quitting. All three tailored intervention groups made significantly more quits attempts (24 hours) than the control group, although there were no differences between the three intervention groups. There were no differences between the intervention and control groups in successful (7 day) quit attempts, but the combined intervention with both outcome information and self-efficacy enhancing information had a significant effect on continued abstinence (12 month abstinence). Although self-efficacy was identified as the mediator for behavioural change there was no assessment of changes to self-efficacy at follow-up.

Kreuter and Strecher (1995) looked at enhancing the effectiveness of a health risk appraisal (HRA) to promote healthy behaviour. Health risk appraisal is the risk of mortality based on personal risk information. The healthy behaviours addressed were cholesterol testing, fat intake, exercise, pap smear, seat belt use, mammography and quitting smoking. 1317 adults randomly selected from general practices were then randomised to one of three experimental groups. Participants either received enhanced HRA (tailored group), typical HRA (general group) or no HRA (control group). The enhanced HRA involved information tailored to individual problem behaviours by perceived barriers, reasons for wanting change, risks, benefits and self-efficacy as well as general information about risky behaviours. Participants in this group received information on all the behaviours that they needed to change and were interested in changing, which meant that the reports were of varied length. The general intervention consisted of the general information about risky behaviours. To assess the impact of the intervention, participants were asked about behaviour changes and intentions to change behaviours at a six-month follow-up. There were decreases in the amount of fat consumed and increases in the number of participants having cholesterol tests. However, for the majority of health behaviours studied there were no differences between groups. The results suggest that tailored HRAs can have a positive effect on uptake of certain health behaviours. There was no impact of the general intervention in comparison to the control group. The lack of effect on some behaviours may have been due to the individuals electing to focus on just one behaviour for change.

Neither of these studies looked at other outcomes apart from behavioural change, therefore it is difficult to determine whether the identified mediators (e.g. attitudes, skill, expectations, etc.) of change were affected by the intervention. It would be interesting to look at the impact on the intervening variables.

Stages of change

One model which has been widely used in intervention studies, is the Stages of Change Model, which suggests that individuals can be categorised into their stage of readiness to change, and that appropriate interventions vary by stage. It has been used in work on smoking cessation, mammography screening and exercise. The stages of change model was developed in the early 1980's by Prochaska and DiClemente (1983) to understand intention to participant in smoking cessation programmes and psychotherapy. As has been discussed earlier, there are five stages of change: precontemplation, contemplation, decision making, action and maintenance. Each of these stages is characterised by differences in psychological factors such as the perceived benefits and costs of change, and self-efficacy. It has been proposed that different types of information are more relevant at different stages of change. For example people in the precontemplation stage who have no intention to change behaviour are more likely to be receptive to consciousness-raising to alert them to the benefits of change. Participants in the contemplation and decision making stages should benefit from skills information to enhance their ability to change their behaviours, and those in the action and maintenance stage should benefit from advice on how to avoid relapse, such as recruiting social support.

The early work carried out on interventions tailored to the stages of change model was conducted by Prochaska, DiClemente, Velicer and Rossi (1993) using a four group design to look at the effectiveness of tailored interventions for smoking cessation. In this study participants had responded to newspaper advertisements asking for volunteers to test self-help materials for smoking cessation. The four experimental conditions comprised a general intervention group with a standard self-help manual, and three tailored groups. One tailored group received a manual tailored to their stages of change, the second group received an interactive computer report plus the tailored manual, and finally, the third group received personal contact with the interactive computer report and the tailored manual. Participants were sent the appropriate manual based on their stages of change level before the intervention and followed up at 5, 12 and 18 months to assess abstinence levels. The group which received both the stage-matched manuals and the interactive computer report achieved the highest abstinence measures. The outcome for the stage-matched, manual only, group was not significantly different from the standardised manual at 12 months, but by 18 months the stage intervention was more effective. The individualised manual with the expert computer system was the most effective intervention condition. This indicates that interventions matched by stage can have an important effect on behaviour in the long term. The psychological measures taken at baseline were not reassessed at follow-up to check whether the intervention had influenced self-efficacy and decisional balance, the hypothesised active ingredients in the tailored intervention.

Skinner et al (1994) looked at the impact of a tailored intervention compared with a standard intervention to increase intention and attendance for mammography. 435 women who had attended screening within the past 2 years and who had a telephone were randomly selected from 2 general practices. The standard condition consisted of a letter based on national recommendation whilst the individualised letter was tailored by stages of change, and beliefs at baseline. Both letters also had a picture of a woman on them, with the individualised letter picture tailored by ethnicity with accompanying captions tailored by stages of change. The outcome measure in this study was stages of change for mammography utilisation. Participants in the tailored condition were more likely to remember reading the letter, but there were no differences in stages of change at follow up in the group as a whole. However there were significant differences for black women and women who had lower household incomes receiving the tailored intervention. The results are indicative of positive outcome of tailoring although the results were not significant for the group as a whole.

Rakowski et al (1998) also used a stage matched tailored intervention to encourage mammography screening in a sample of 1,397 women within a Health Maintenance Organisation. In this study a three group design was used with a control group, general information group and a tailored information group. The control group received no materials, the general group received standard information about breast health and information on importance of regular check-ups, and the tailored group received the same information as the general group and, additionally, an educational leaflet tailored to stages of change based on answers to a baseline questionnaire. This tailored letter addressed the processes of change and the decisional balance for change. Significantly more participants in the stage-matched intervention attended for screening when compared with the general intervention and the control groups. Using a mailed intervention tailored by stage resulted in significant improvements in attendance for mammography.

Another example of a stage-matched intervention is the work done by Marcus et al (1998) who compared a general intervention with a tailored intervention for uptake of physical activity. Participants (n=194) were recruited through newspapers and randomly allocated to a tailored or general intervention group. The individually tailored interventions were again tailored by readiness to change behaviour, and given information relevant to this, with regard to the processes of change and levels of self-efficacy. At follow-up the individually tailored group were spending more minutes per week taking exercise, and a higher percentage of people in the individually tailored group (44%) were achieving the recommended levels, than in the standard intervention group (18%). Changes in psychological variables (self-efficacy, decisional balance, perceived benefits and perceived costs, cognitive processes and behavioural processes) were also evaluated at follow-up, showing increases in self-efficacy, benefits, and cognitive processes over time for both groups. The group who received the individually tailored intervention reported more minutes of activity per week than the standard intervention at 1 month, 3 month and 5 month. At 5 months there was a significant group by time interaction with the tailored group participating in 151.4 minutes per week compared to 96.5 minutes in the standard group. Using this model enables participants to receive information pertinent to their readiness to change behaviour supported by information about the processes involved in such change.

Tailoring of interventions has had varied levels of success in a variety of health behaviours discussed above. Although there are many ways to tailor interventions, for example, taking account of demographic, behavioural and psychological information collected at baseline, tailoring by stages of change seems to be the most positive in terms of behavioural change as illustrated in Table 2. The interventions tailored by stages of change have all shown positive changes to the health behaviours being addressed. A problem with most of the studies just described is that they focus mainly on behavioural outcomes of change which whilst indicating the success of intervention do not tell us anything about how and why they work. Also, the health behaviours studied here are quite explicit and identifiable which may contribute to their success in change. Measurement of these factors is relatively easy and changes can be detected in both a short and long time.

Table 2 Tailored interventions for health behaviours

Study	Target behaviours (n)	Sample characteristics	Tailored by	Intervention conditions	Behavioural outcomes
Kalichman et al (1993)	HIV/AIDS risk reduction (1)	106 black American women recruited from health centres	Gender (G), ethnicity (E) and cultural values (CV)	General video Tailored video (G+E) Tailored video (G+E+CV)	↑ screening and requesting condoms for tailored video (G+E+CV)
Kreuter & Strecher (1996)	Cholesterol testing, fat, exercise, pap smear, seat belt use, mammography and quitting smoking (6)	1,317 adults from general practices	Attitudes	Control ,General , Tailored	↓ fat consumption ↓ cholesterol screening in tailored intervention group only. ↔ other behaviours
Dijkstra et al (1998)	Smoking cessation (1)	1,546 adults recruited through newspapers advertisements	Outcomes (O) and self-efficacy (SE)	Control Tailored (O) Tailored (SE) Tailored (O+SE)	O+SE ↑ continued abstinence. 3 tailored groups ↑ 24 hours quit attempts. ↔ between groups for 7 day quit attempts
Rakowski et al (1998)	Mammography screening (1)	1397 women from Health organisation	Stages of change	Control, General, Tailored	↑ attended for screening in tailored group
Prochaska et al (1993)	Smoking cessation (1)	756 adults recruited from newspaper advertisements	Stages of change	General Tailored (T) T + interactive computer (IC) reports T + IC + counselling	↑ smoking cessation for tailored groups T and IC ↑ abstinence rates.

Table 2 continued

Marcus et al (1998)	Exercise (1)	194 adults recruited through newspapers advertisements	Stages of change	General , Tailored	Tailored group ↑ in weekly exercise and ↑ recommended levels
Brug et al (1996)	Fat, fruit and vegetables (3)	347 work site employees	Attitudes, self-efficacy & social influence	Tailored , General	↓ fat for tailored group ↔ fruit or vegetable
Brug et al (1998)	Fat, fruit and vegetables (3)	646 adults recruited through newspapers advertisements	Attitudes and self-efficacy + info on change to behaviour	Tailored +iterative feedback (T+IF) Tailored General	↓ fat. ↑ fruit intake in (T+IF) ↑ vegetables in all groups
Brug et al (1999)	Fat, fruit and vegetables (3)	315 work site employees	Dietary feedback (DF) and psychosocial info (PI)	Tailored (DF) Tailored (DF+PI)	↓ fat ↑ fruit. No diff between groups.
Marcus et al (1998)	Fruit and vegetables (2)	142 callers to a cancer information service	Stages of change, and barriers	Tailored , Control	↑ fruit and vegetables
Campbell et al (1994)	Fat, fruit and vegetables (3)	558 patients contacted through GP clinic	Stages of change, attitudes and self-efficacy	Tailored , General, Control	↓ in fat ↔fruit or vegetables.

↓ significant decrease

↑ significant increase

↔ no change

Tailoring for dietary behaviour

Dietary behaviour is a behaviour which is embedded in everyday life. Everybody has to eat, although they may not be aware of the quality or quantity of food which they are eating. Dietary behaviour is the most recent health behaviour to be targeted using tailored interventions, perhaps because change is less easy to formulate than other behaviours. The two most common types of dietary behaviour targeted are fat intake, and much more recently, intake of fruit and vegetables. Dietary interventions have had much more varied levels of success than those with the other health behaviours already described.

Tailoring by dietary feedback

The earliest studies using tailored interventions involved giving participants feedback about their present levels of intake (Greene, Rossi and Richards Reed , 1993; Bowen, Fries and Hopp, 1994). Both Greene, et al (1993) and Bowen, et al (1994) looked at dietary fat content, tailoring feedback to present intake levels. Greene et al (1993) used computer generated feedback given to 155 college students and staff. This involved suggestions on how to reduce fat based on baseline measures of fat intake and eating patterns. Intentions to reduce fat intake increased for participants who were told they were consuming more than the recommended levels, and therefore given suggestions on how to make change. Bowen et al (1994) gave participants feedback about their present consumption levels in relation to the national average, characterising participants as low risk, medium risk or high risk. Participants were asked about perception of the feedback, self-efficacy, knowledge and intentions to change behaviour as some of the psychological measures. The group who received the high fat feedback had lower intentions to change behaviour and also greater emotional distress then those in the lower risk groups. This indicates that grouping individuals for intervention can have significantly different impacts on psychological variables at follow-up. These differences in psychological variables may be related to differences in behavioural aspects later on. One of the methodological problems with these two studies is that, neither of these studies looked at behavioural changes at follow-up and therefore conclusions are only speculative.

Advances in tailoring for dietary behaviour

Work on tailoring has benefited greatly from computer technology. This has enabled interventions to be tailored at the same time to a very large number of behavioural and psychological characteristics of participants. Typically, these types of intervention studies would collect data at baseline and using a computer package merge this information for the individuals, which produces an intervention which may be in the form of a letter, leaflet or report. Using computers means that intervention programmes can, relatively easily be tailored to a much larger number of variables. This approach has been used in dietary research because it enables researchers to tailor interventions at one time to a selection of different dietary behaviours. Much of the work on tailoring of dietary interventions has been carried out simultaneously on fat, fruit and vegetable intake (Campbell et al, 1994; Brug et al, 1996; 1998; 1999a).

Campbell et al (1994) used computer-generated leaflets tailored using the stages of change model to address consumption levels, attitudes and self-efficacy for fat, fruit and vegetables as measured at baseline. Baseline questionnaires were given out to 558 patients attending general practice clinics (women=73%). This study focused on changing eating behaviour using a 3-group design which tested the effectiveness of a tailored intervention compared to a general intervention and no intervention group. Participants were followed-up four months after distribution of the intervention. There were significant differences in fat intake (total fat and saturated fat) between the tailored group and the control group at follow-up, although there was no group by time interaction when all three groups were analysed. However there were no significant changes in fruit or vegetable intake for any groups at follow-up. Nevertheless, participants in the tailored group were much more likely to remember receiving the intervention and much more likely to recall reading all of it.

Brug et al (1996) tailored their dietary intervention to attitudes, self-efficacy and social influence in relation to fat, fruit and vegetables. A 2-group design was used, with a tailored intervention group and a general intervention receiving general nutrition information. The sample of 347 was drawn from a largely male (83%) work site setting. Again there were positive changes in fat intake as a result of the tailored intervention with a reduction in daily intake of fat in the diet, but no differences in fruit or vegetable intake.

In another study with three groups, Brug et al (1998) looked at the effectiveness of a tailored intervention plus iterative feedback compared to just a tailored intervention and a general intervention in a female sample recruited through the media. The tailored intervention was tailored to participant's intake, intention, attitudes, self-efficacy and self-rated behaviour and took the form of a letter like the previous study. The iterative feedback, which was in an additional letter, consisted of information about changes in individual's intake of fat, fruit and vegetables. Participants were followed up at four and eight weeks to assess changes in intake and also the subjective impact of the interventions. Significant differences in pre and post intake were found for fat, fruit and vegetables between groups but again the effect was stronger for fat than fruit and vegetables. This study showed that using tailored interventions with iterative feedback or tailored interventions alone, had significantly more impact on fat intake then the general intervention. There were significantly greater changes in intake of fruit and vegetables for the tailored plus iterative feedback compared to the other intervention groups. However for fruit and vegetables, there was no interaction between intervention groups over time for fruit (ns) or vegetables ($p=0.12$). Overall, participants rated that they were much more likely to have read the tailored letter. They also felt that they had increased their intake of fat, fruit and vegetables whether or not they actually did. This study shows positive results for the impact of tailored interventions and tailored plus iterative feedback for healthy dietary changes over time.

Brug et al (1999a) compared two tailored interventions amongst a predominantly female sample (89%) working for a home care organisation. 347 participants took part in the study from an initial 595 (50%) who were mailed questionnaires. The two tailored conditions were letters, one which consisted of an intervention tailored by dietary habits and present behaviour alone and the other was an intervention which was also tailored by psychosocial information (attitudes, self-efficacy and social support). Significant decreases in fat intake and increases in fruit intake were found for the whole sample. When only those with either high fat or low fruit or vegetable intake were examined there were significant changes to all three outcome behaviours. However, there was no difference in intake between the two types of tailored intervention. It was concluded that tailored interventions do increase intake but that additional psychosocial information does not add to the impact of the intervention. Thus basic dietary information tailored to individual behaviour was as effective as information which also took account of personal beliefs and perceptions.

Although the previous studies were able to show changes in intake of fat, and occasionally fruit and vegetables, the differences in fruit and vegetable intake were poorer than that of fat intake. Only the Campbell et al (1994) study used a control group which received no intervention as a comparison. All the other studies lack information about natural population changes and also the possible expectancy bias that may have occurred as a result of receiving the interventions. Therefore one cannot be sure of the efficacy of the general intervention on behaviour. It is even possible that they have fared worse than would have done without an intervention.

Tailored interventions appear to be a useful means of changing behaviour. However, they have been relatively unsuccessful for changing consumption of fruit and vegetables. One explanation for the poor results may be that tailoring to three aspects of dietary change is too complex. It is also possible that participants are more familiar with the arguments in favour of fat reduction, and also elect to focus their efforts there. The lack of knowledge about fruit and vegetables may be associated with the poor changes to this behaviour. Participants may perceive the costs of increasing intake as greater than the benefits. Those interventions which have only had one target behaviour have faired much better than interventions where participants have had several outcomes to address.

In support of this idea that changes in fruit and vegetables need a focus on fruit and vegetables only, Marcus et al (1998) conducted a tailored intervention specifically aimed at changing fruit and vegetable intake. Participants were callers to a cancer information service who were phoning up for information but who did not have cancer themselves, who either received educational information which was tailored by stages of change and barriers to change or no information. The results showed a significant increase in fruit and vegetable consumption at both 4-week and 4-month follow-ups. Although significant effects of the intervention were maintained over some time this study had a selective sample. The types of people phoning up for cancer information were more likely to be women who were concerned about their health. As those people in the intervention group were additionally mailed information about increasing intake relevant to their present levels, it is difficult to know whether the tailored, telephone information or the mailed printed material had the effect on behaviour.

Havas, Anliker, Damron, Langenberg, Ballesteros and Feldman (1998) carried out a large-scale program as part of the 5 A Day program, which was instigated in the United States in the early 1990's. Participants were 3122 women from the WIC program which consisted of women from low income background. This program was designed using a theoretical model to formulate a multidimensional intervention programme. The aims of the intervention were to increase intake of fruit and vegetables as well as other relevant psychological factors. The intervention included three aspects; nutrition education session, printed material and direct mail. The direct mail information was tailored specifically to baseline measurements of stages of change, pregnancy status, attendance at the nutrition session and goals for changing intake. This sample differs from other samples because the majority of participants were black. Unlike the other 'tailored intervention' studies this did not test the efficacy of a tailored intervention so is only discussed for illustrative purposes. Significant increases were found in the intervention group for intake of fruit and vegetables, knowledge, attitudes and self-efficacy when compared to the control group at two month follow-up. Whilst the intervention had an impact on both behavioural and psychological outcomes, it is not clear which aspects of the intervention contributed to this change. Due to the multifactorial nature of the intervention it is impossible to conclude whether the tailored aspect had any impact at all on behaviour. However it does show the feasibility of sending out tailored information to large samples of women as long as the information is tailored by a limited number of factors.

Summary of tailored interventions: success or failure?

Intervention studies which have evaluated health behaviours other than dietary behaviour have indicated that tailoring is a useful method for giving groups of people information specific to their needs. This approach has enormous potential for use in the public health domain for improving a variety of health behaviours. Further work is needed to find out why and how these interventions improve smoking cessation rates, encourage attendance for types of screening, improve risk reduction for HIV and AIDS, and get people to participate in more physical activity.

The research which has tailored interventions for dietary behaviours has had less clear cut results (See Table 2). Whilst interventions which have addressed reduction of fat have generally had positive outcomes, those which have simultaneously tried to improve intake of fruit and vegetables have had poor results. Only one study, as aforementioned, has shown a significant effect of tailoring on fruit and vegetables compared to no intervention. One other characteristic of interventions which might affect their generalisability is the samples used. Many of the studies have had a majority of one gender which means that information produced is only relevant to either men or women. Those studies which have had a good mix of men and women have tended not to examine possible gender differences in changes to behaviour. In dietary interventions it is likely that there are gender differences in a number of the psychological factors associated with diet as well as intake itself as has already been demonstrated. For many of these studies the samples have been self selected by being invited to take part in programmes via the media or by phoning up for information which would only attract a very selective group of people. This is likely to mean that some groups of the population will be excluded such as people with lower educational levels and who are more socio-economically deprived by virtue of their not having access to a phone, not having a job or not buying certain newspapers. Methodologically many of these studies are weak in terms of the conclusions being made, taking account of intensity, sampling, application and outcomes.

Much of this work has focused on showing the value of tailoring against more traditional interventions which are the same for everybody and which historically have had little impact on behaviour. The main concern is to get an effective intervention. However it is also important to understand why tailoring is more effective than general interventions and also to find out which aspects of the tailoring are the mostly important, to unpack some of the experimental effects. To do this larger sample of participants, from more varied backgrounds need to be involved in studies. It is important to assess whether there are changes in intervening variables as a result of the interventions, in order to gain some insight into the psychological changes associated with the intervention. Studies need to include control groups to look at variations in behaviours and psychological variables over time, and more investigation is needed into which aspects of interventions are the most successful.

Chapter 3 Psychosocial predictors of fruit and vegetable intake in older adults

Introduction

The aim of this study was to investigate psychosocial factors associated with the level of intake of fruit and vegetables. It is well established that consumption levels of fruit and vegetables are below recommended levels of at least 5 servings (400 gms) a day in the UK population (Dietary and Nutritional Survey for England, 1990). However why this occurs is not so well established. A number of studies have looked at the role of knowledge and attitudes. Knowledge is considered important because it could be assumed that a rational consumer would, other things being equal, do what they understand to be best for their health. Attitudes are studied because they give meaning to an individual's perception of an event, and help to make sense of people's behaviour. They are the central feature of many social cognition models, such as the Theory of Reasoned Action (Fishbein and Ajzen, 1975), and the Theory of Planned Behaviour (Azjen and Madden, 1986), both of which hypothesise that people's evaluation of a behaviour are significant determinants of their intention to carry it out.

The present study was concerned with the association between knowledge, attitudes and behaviour. Whilst the majority of studies suggest that attitudes are associated with behaviour, the association between knowledge and behaviour is not so clear cut. The majority of the work looking at these three factors has been carried out on fat intake with little emphasis on how these factors work together for fruit and vegetable intake. Therefore this study aims to test the hypothesis that people with low levels of nutritional knowledge, and more negative attitudes, consume less fruit and vegetables.

It is also important to examine demographic differences in behaviour, knowledge and attitudes. Women have been shown to consume better diets and know more about what constitutes a healthy diet (Fagerli & Wandel, 1999), so any association between knowledge and behaviour could be a result of both being linked with gender. The role of other demographic characteristics is poorly understood and needs further investigation. Therefore this study examines the association between nutritional knowledge and attitudes and intake of fruit and vegetables, and investigates how they relate to demographic variations. It also tests the idea that differences in knowledge and attitudes might mediate the demographic differences in intake, i.e. people with higher levels of socio-economic deprivation eat less fruit and vegetables partly because they are unaware know that they should do otherwise .

The data described in this paper come from a survey which was carried out in a cancer screening clinic to collect baseline information for a tailored dietary intervention.

Methods

Participants for this study were drawn from adults (aged 55-65) attending bowel cancer screening clinics in Newport, Leicester and Glasgow, as part of an ongoing evaluation of the efficacy of flexible sigmoidoscopy screening for prevention of bowel cancer (Atkin, Hart, Edwards, McIntyre, Aubrey, Wardle, Sutton, Cuzick, and Northover, 1998). This is a major study being carried out across the UK presently. The screenees had been selected by a letter from their GP asking about interest in the flexible sigmoidoscopy test. Those who were interested (70% of the initial sample) were then randomly allocated either to be invited for screening or to a control group. 15 screening centres over the UK were participating in the study. Three centres were selected for use in the present study, based on appropriateness of data collection (e.g. clinics where patients had not already received additional questionnaires) and diversity of sub populations (e.g. different areas of the UK).

Procedure

Participants were approached by staff at the clinics and invited to complete a questionnaire on diet. This was usually done after their screening examination, when they had to rest for some time before leaving the clinic. The majority of participants completed the questionnaire while waiting at the screening clinic. The exception to this was the Glasgow clinic where problems of numbers and clinic layout meant that some participants were allowed to take questionnaires home to complete and return in freepost envelopes provided. The main reasons given for refusal to complete questionnaires were lack of time or physical incapacity (e.g. no glasses).

Development of the baseline questionnaire

Piloting of the questionnaire was conducted in both cancer screening clinics and dental clinics, to ensure readability and comprehensibility of the questionnaire and to check on the feasibility of data collection. Various pilot versions were completed by approximately 70 people before a final version of the questionnaire was decided upon. As a result of piloting, the length of the questionnaire was reduced and clearer instructions were given for certain questions e.g. that potatoes were not to be included as a vegetable. See Appendix 2 for final version of questionnaire.

Measures

Intake

Intake of fruit and vegetables was assessed by using single item summary questions, since they have been shown to be reliable when compared to more complex measures (Block et al, 1986) such as food frequency or food diary measurements, and less likely to overestimate daily intake over time. Participants self-rated their own intakes for both fruit and vegetables by ticking one of 8 boxes indicating frequency of consumed servings *(< 1 a week / 1-2 a week / 3-4 a week / 5-6 a week / 1 a day / 2-3 a day / 4-5 a day / 6+ a day).* Serving descriptions based on recommendations from the Health Education Authority (1992), were given to avoid any misinterpretation. Therefore the description of a 'normal servings' was approximately 80 grams. *e.g. an apple or a small bowl of raspberries.* Minimum and maximum levels were used because it was felt that there would be few people who consumed the minimum amount of less than once a week and also few people that would eat more than 6 servings of fruit or vegetables a day.

Participants also indicated how long they had been having this number of servings, with five response options from less than a month to more than 2 years. This was included to check for recent changes in intake levels and to show stability of behaviours.

Perception of adequacy of intake was assessed by asking participants to indicating whether they ate 'too much', about right', or 'not enough' fruit and vegetables. This was included to look at whether participants had realistic perceptions of their intake.

Participants were also asked whether they were on a special diet, and if so the type of diet.. Examples of diet types given were weight loss, vegetarian, diabetic, etc. and participants were asked to specify diet type.

Attitudes

Attitudinal items were selected on the grounds that they had been identified as correlates of intake in other studies (Cox et al, 1996, Treiman et al, 1996). They included perceived convenience, taste, price, storage, ease of preparation and availability, which were separately applied to fruit and vegetables. These items were phrased as statements, with rating made on a four point Likert scale from strongly agree to strongly disagree.

Table 1 Attitude statements
Fruit/Vegetables make a convenient snack
Fruit/Vegetables taste delicious
Fruit/Vegetables are expensive
Fruit/Vegetables don't keep very well
Good fruit/vegetables can bought at my local shops
Vegetables are easy to cook
Fruit is easy to prepare

Disagreements with a positive statement or agreements with a negative statement were classified as negative attitudes. Each item was scored between 1 and 4 depending on positive/negative direction.

Knowledge

Items from Parmenter and Wardles' (1999) Nutritional Knowledge Questionnaire were used to assess knowledge of the nutrient characteristics of fruit and vegetable, and the relationship between intake and major disease. Participants had to indicate whether they knew of any major diseases relating to intake of fruit and vegetables. They were also asked *'how many servings of fruit and vegetables (combined) per day do health experts recommend?'*. Those who selected 5 or more servings a day were classified as correct.

A section on nutrient content was added, following discussion with a dietician. Estimation of levels of vitamins and fibre content in fruit and vegetables was assessed by selecting particular ratings. (*e.g. very low / low / high / very high).* Selecting either 'low' or 'very low' for vitamins and fibre was counted as incorrect.

Demographic measures

Simple background information was collected to examine the representativeness of the sample and also to look at differences in behaviour, and knowledge and attitudes in relation to demographic characteristics. Demographic questions include age, gender, ethnicity, educational level, car ownership, housing tenure and work status. Participants were asked to classify themselves based on ethnic background, with choices of 'White', 'Black', 'Asian' or 'Other'.

Highest level of education completed was assessed by participants selecting from the following categories; primary school, secondary school, technical/trade certificate, diploma, degree and post graduate degree. These categories were selected because participants came from England, Scotland and Wales where there were different qualifications. This enabled participants to all rate highest education level on a comparable scale.

Socio-economic deprivation was indexed with items from Townsend, Phillimore and Beattle (1988) measure of social economic status. Car ownership and housing tenure were included as measures of socio-economic deprivation. Unemployment and overcrowding have not been included as they were not appropriate to this age group which had a high proportion of people who were retired and lived alone. Pugh, Power, Goldblatt and Arber (1991) used housing tenure and access to a car as a measure of SES and found that this defined SES differences better than traditional methods, when looking at lung cancer mortality in women. Whilst this is a relatively crude measure, it will be used as an indicator of socio-economic deprivation. Therefore conclusions drawn are based on this, and are not interpreted as socio-economic status per se.

Participants were also asked to select one of four work status groups; working full-time, working part-time, not working and retired, although because of the age of this sample work status was not included within any summary of socio-economic conditions.

Anthropometric measures

Participants were asked to report their height and weight, so that Body Mass Index could be calculated. Self-reported heights and weights have been shown to be fairly accurate when compared to measured height and weight (Lass et al, 1982), although participants who have higher measured BMI are more likely to over estimate height and under estimate weight. In this study, participants have been broadly grouped which should limit the impact of these incorrect estimations.

The questionnaire was designed so that it was easily interpretable, simple to complete and could be finished in the time allocated. On the front of the questionnaire was an explanation of who was conducting the study and why, with reassurances of confidentiality. A contact name, address and telephone number were also given.

Test-retest reliability of the questionnaire

Reliability testing was conducted to look at the consistency of the questionnaire responses over time. Reliability was assessed on 22 participants who filled in two identical questionnaires two weeks apart. Participants for the pilot testing were selected to reflect the participants in the study so were therefore aged between 50 and 65 years with an even split of men and women. Retest reliability was assessed using a Pearson correlation. Correlation coefficients are shown in Table 2.

Table 2 Retest reliability for questionnaire

	r_r	p<
Fruit intake	0.90	0.001
Vegetable intake	0.85	0.001
Recommended servings of fruit and vegetables	0.92	0.001

Fruit and vegetable intake and estimations about health recommended servings were all very highly correlated between Time 1 and Time 2 with correlation coefficients of over 0.82.

Baseline data

The sample of respondents comprised 1054 adults attending screening at one of the three bowel cancer screening clinics. Three respondents were excluded from the data analysis for not meeting the age criteria of 55-66 years of age. Due to a presentation flaw, 51 people did not complete all of the items (missed first or last page), but their other data have been included where possible.

There were good response rates for questionnaire completion and return in this study, as shown in Table 3.

Table 3 Response rates for questionnaire completion in 3 clinics

	Questionnaires distributed	Questionnaires completed	
		N	%
Leicester	510	500	98
Glasgow	347	250	72
Newport	396	304	77

At the Leicester centre, where there were more clinic staff to help with the coordination of data collection, refusal rates for questionnaire completion were very low. Indications are that in the Glasgow and Newport centres, questionnaires were not handed to, or collected from, all patients attending for screening. Therefore the lower response rates were probably attributable to different distribution and collection rates, and not to lower levels of interest.

Sample characteristics

Demographic characteristics (illustrated in Table 4)

There were 485 (48%) men and 523 (52%) women in the sample with a mean age of 59.9 years (median 60 years). 47% of the sample came from the Leicester centre, 29% from Newport, and 24% from Glasgow. Women had lower educational levels (χ^2=60.59, df [4], p<0.001) and fewer worked full-time (χ^2=165.3, df [3], p<0.001) than men. The majority of the sample were reasonably well educated, with 63% having an educational level equivalent to secondary school and 39% having some higher education. There was minimal ethnic diversity with respondents classified as 'white' (995, 99%) making up the majority. Most respondents were either working full-time (33%) or retired (41%).

The majority of participants owned a car (86%) and owned their own home (87%). Economic deprivation was indexed by car ownership and housing tenure (scoring 0-2). On this basis, 80% were from lower economic deprivation levels (i.e. were home owners with a car). Respondents from Glasgow had higher education levels (χ^2=45.98, df[8], p <0.001) but had higher levels of economic deprivation (χ^2=47.78, df [4], p<0.001). The higher education level in Glasgow is probably due to past differences in the education system in Scotland.

Table 4 Distribution of demographic characteristics of sample

	Men		Women	
	n	**%**	**n**	**%**
	485	48	523	52
Mean Age	59.6±	2.96	60.1±	2.90
Centre				
Newport	134	28	140	27
Leicester	239	49	246	47
Glasgow	112	23	137	26
Qualifications				
Primary	28	6	20	4
Secondary	230	48	344	67
Trade	112	24	46	9
Diploma	38	8	61	12
Degree	68	14	44	8
Work status				
Working full-time	251	52	77	15
Working part-time	37	8	113	21
Not working	39	8	73	14
Retired	157	32	260	50
Car ownership				
No car	54	11	85	16
Car	426	89	437	84
Housing tenure				
Home owner	418	86	458	88
Other	67	14	64	12
Economic deprivation	**(indexed by car ownership and housing tenure (0-2))**			
High (2)	30	6	37	7
Medium (1)	58	12	75	14
Low (0)	392	82	409	79

Anthropometric measures and diet status

Body Mass Index (BMI; kg/m$^{2)}$ in the sample ranged from 17 to 47 with a mean of 25.7. 44% of the sample had a BMI below 25, with 42% overweight and 14% of participants being classified as obese.

156 (15%) of the total sample were on a diet of some kind, with low fat, weight loss, vegetarian, and diabetic diets being the most frequently mentioned. Table 5 illustrates BMI and diet status. Significantly more women (18%) were on a diet than men (12%) (χ^2=8.10 df [1], p<0.001) with low fat diets being the most popular for men, and weight loss diets the most popular for women.

Table 5 Body Mass Index and diet history for men and women

	Men		Women	
Height (cms)	174.4±	7.6	161.3±	6.9
Weight (kg)	79.0±	11.9	68.5±	12.4
BMI	25.5±	3.4	25.8±	4.6
	n	%	n	%
Body Mass Index (BMI)				
<25 (normal weight)	262	55	286	56
25-29.99 (over weight)	180	38	149	29
≥ 30 (obese)	35	7	70	14
Diet				
No	425	88	423	81
Yes	58	12	96	19
Type of diet (% of those on diet)				
Weight loss	12	20	46	48
Vegetarian	9	15	8	8
Diabetic	12	20	11	12
Low fat	18	30	23	24
Other	9	15	8	8

Fruit and vegetable intake

Distribution of weekly fruit and vegetable servings are illustrated in Figure 1 for fruit and Figure 2 for vegetables.

Figure 1 Distribution of servings of fruit

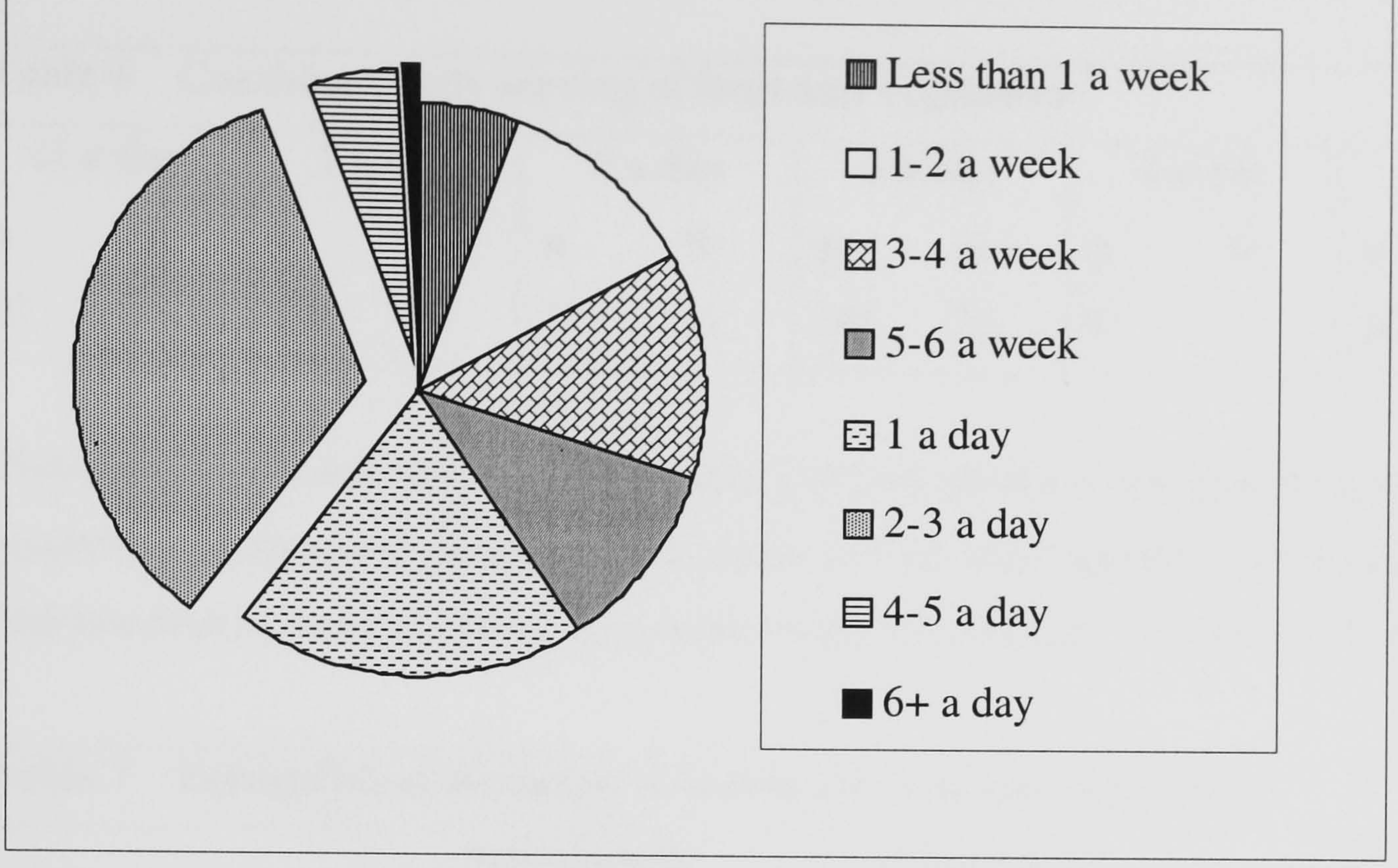
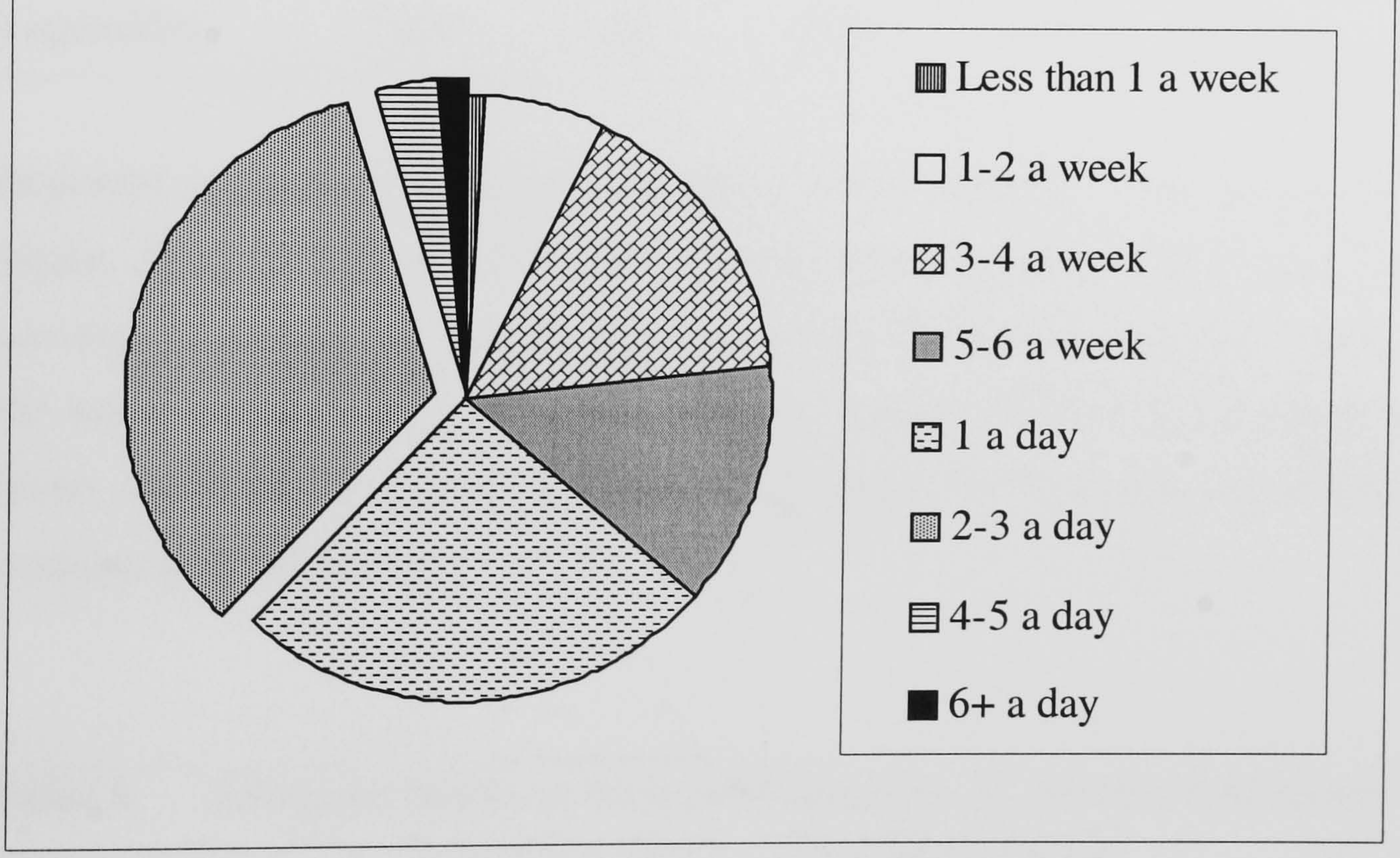


Figure 2 Distribution of vegetable servings



Fewer than half of the sample reported eating as much as 2 servings of fruit a day or vegetables a day. When the data was combined to look at total daily servings of fruit and vegetables only a quarter (25%) ate at least 5 servings a day (See Table 6), and only 21% of the sample ate the appropriate proportion of both fruit and vegetables (at least 2-3 of each per day). The mean intake for fruit and vegetables was approximately 3.02 servings (s.d.=1.92) combined a day with a median of 3 servings. Participants who reported eating more servings of fruit tend to report eating more servings of vegetables. ($r_p = 0.34$, $p<0.001$),

Table 6 Combined daily serving of fruit and vegetables											
<1 a day		**1 a day**		**2 a day**		**3 a day**		**4 a day**		**5+ a day**	
n	%	**n**	%	**n**	%	**n**	%	**n**	%	**n**	%
82	9	278	28	119	11	262	26	6	1	265	25

Participants were asked to rate the adequacy of their present consumption levels and the majority of participants perceived their intake of fruit and vegetables as the 'about right' and less than a third perceiving their intake to be 'not enough' as shown in Table 7.

Table 7 Perception of adequacy of intake for fruit and vegetables.						
	Not enough		**About right**		**Too much**	
	n	%	**n**	%	**n**	%
Fruit	299	30	696	69	14	1
Vegetables	202	20	800	79	9	1

Reported servings of fruit and vegetables were associated with perceived levels of intake. About 61% of people were correct in their evaluation (about right = at least 2-3 servings or not enough <2-3 servings) and 52% correct for vegetable intake. Most of the rest overestimated their perceived intake levels. Table 8 demonstrates the intake levels dependent on perceived adequacy of intake for fruit and vegetables, typically evaluating as 'about right'.

Table 8 Adequate intake of fruit and vegetables by perceived adequacy of intake						
	Not enough		**About right**		**Too much**	
	n	%	**n**	%	**n**	%
Fruit						
< 2 servings a day	258	43	342	56	5	1
>= 2 servings a day	40	10	353	88	9	2
Vegetables						
< 2 servings a day	174	28	445	71	7	1
>= 2 servings a day	28	7	353	92	2	1

Nutritional knowledge

Nutritional knowledge was assessed with questions about recommended servings, the relationship between diet and major health problems, and the nutrient content of fruit and vegetables. Only 45% (527) of the sample correctly estimated the number of recommended servings to be at least 5 servings of fruit and vegetables a day (see Table 9). The mean estimated number of recommended servings was 3.99 a day (sd = 1.67) with a median of 3. Only 31% of the sample said they knew of a relationship between intake of fruit and vegetables and major health problems or diseases. Knowledge about the relationship between intake and major diseases was correlated with correct knowledge about recommended servings ($r_s = 0.18$, $p<0.001$), but only 19% knew about both recommended servings and major diseases.

Table 9 Estimated health recommended servings per day

1 a day		2 a day		3 a day		4 a day		5 a day		6 a day		7+ a day	
n	%	n	%	n	%	n	%	n	%	n	%	n	%
44	5	189	20	153	16	132	14	308	32	89	9	44	4

Nutrient content was measured by asking participants to estimate the levels of vitamins and fibre in fruit and vegetables. See Table 10 for frequency distributions. Those participants who estimated either vitamins or fibre to be low in fruit or vegetable were classified as incorrect. The results indicate that almost none of participants incorrectly estimated the vitamin content of fruit and vegetables, and only a minority incorrectly estimating the fibre content for fruit and vegetables.

Table 10 Nutrient content of fruit and vegetables for fibre and vitamins

	Very low		Low		High		Very high	
Fruit	n	%	n	%	n	%	n	%
Vitamins	3	0	30	3	720	72	244	25
Fibre	10	1	104	10	590	59	289	29
Vegetables								
Vitamins	2	0	35	3	675	69	267	27
Fibre	2	0	37	4	568	58	372	38

Attitudes

Respondents were asked about their attitudes towards both fruit and vegetables.

The data indicate that the majority of respondents had positive attitudes about ease of preparation, availability and taste of fruit and vegetables. However almost half of participants thought fruit and a quarter thought vegetables were expensive, and more than half thought that fruit and vegetables (44%) don't keep very well. Respondents also thought that vegetables did not make a convenient snack (36%). (See Table 11 and 12). The association between attitudes and behaviour will be discussed later.

Table 11 Attitudes to fruit

Attitudes		Strongly disagree		Disagree		Agree		Strongly agree	
Fruit	n	n	%	n	%	n	%	n	%
Convenience-'makes a convenient snack'	988	3	0	30	3	632	64	323	33
Taste- 'tastes delicious'	986	1	0	24	3	594	60	367	37
Preparation- 'easy to prepare'	979	2	0	21	2	690	71	266	27
Quality- 'good fruit can be bought at my local shops'	988	13	1	94	10	683	69	63	20
Price- 'is expensive'	958	54	6	378	39	493	52	33	3
Storage- 'don't keep very well'	951	47	4	452	48	425	45	27	3

Table 12 Attitudes to vegetables

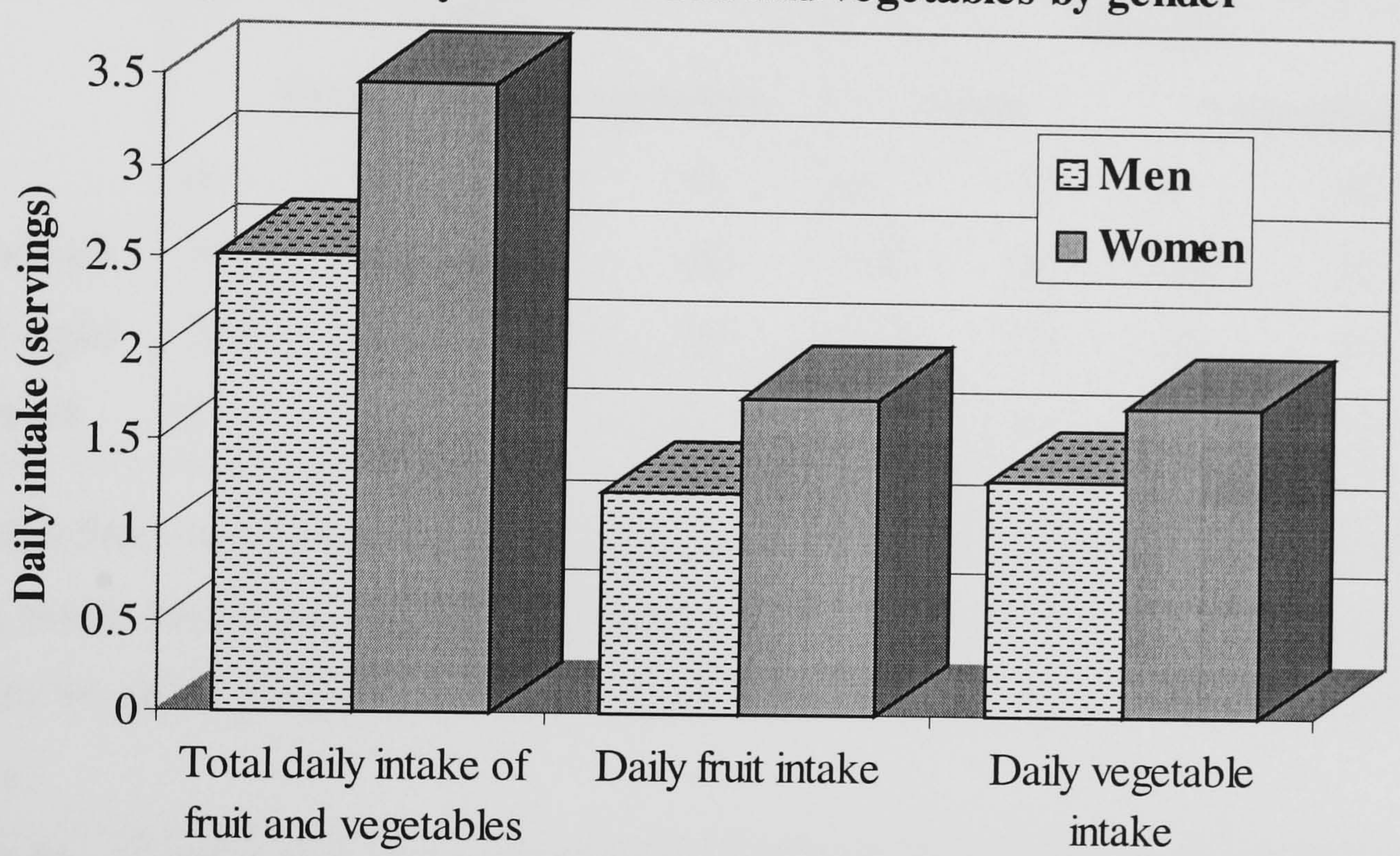
Attitudes		Strongly disagree		Disagree		Agree		Strongly agree	
Vegetables	n	n	%	n	%	n	%	n	%
Convenience- 'make a convenient snack'	932	28	3	307	33	526	56	71	8
Taste- 'taste delicious'	978	7	1	98	10	644	66	229	23
Preparation- 'are easy to cook'	986	3	0	8	1	747	76	220	23
Quality- 'good vegetables can be bought at my local shops'	985	16	2	91	9	682	69	196	20
Price- 'are expensive'	926	33	4	196	21	593	64	104	11
Storage- 'don't keep very well'	937	28	3	382	41	46	5	481	51

Gender differences

Gender differences in intake

Women consumed significantly more *fruit* ($t = 7.10$, df[991], $p<0.001$) and *vegetables* ($t = 5.77$, df[990], $p< 0.001$) than men as displayed in Figure 3. There was also a significant difference in the combined total daily servings of fruit and vegetables, with 2.52 servings for men versus 3.47 servings for women ($t = 8.16$, df[989], $p< 0.001$).

Figure 3 Daily intake of fruit and vegetables by gender



The frequency results in Table 13 show that the percentage of women eating sufficient amounts of fruit (50%) ($\chi^2 = 65.74$, df[8], $p<0.001$) and vegetables (46%) ($\chi^2 = 45.79$, df[8], $p<0.001$) is greater than the percentage of men (29% and 29%).

Table 13 Total daily servings of fruit and vegetables for men and women

	Men		Women	
Total servings	**n**	**%**	**n**	**%**
Less than 1 a day	64	13	27	5
1 a day	165	35	105	20
2 a day	57	12	61	12
3-4 a day	115	24	149	29
At least 5 a day	76	16	172	34

Only 16% of men and 34% of women are eating at least 5 servings of fruit and vegetables a day.

The results indicate that the frequency of perceived adequacy is very similar for men and women, with the majority of both thinking they eat adequate amount of fruit and vegetables. There were no significant differences found in the distribution of perceived adequacy of intake for fruit (χ^2=3.22, df[2], p=ns) or vegetables (χ^2= 0.27, df[2], p= ns).

Table 14 Perception of adequacy of intake by gender

	Men				Women			
	Fruit		Vegetables		Fruit		Vegetables	
	n	%	n	%	n	%	n	%
Not enough	144	30	94	20	149	29	106	21
About right	324	68	377	79	355	69	404	79
Too much	6	1	7	1	8	2	2	0

Although there were no differences in perceived adequacy of fruit and vegetable intake, taking actual intake into account show that more men over estimated their fruit intake (χ^2 = 20.34, df[1], p<0.001) and their vegetable intake (χ^2 = 18.63, df[1], p<0.001), than women.

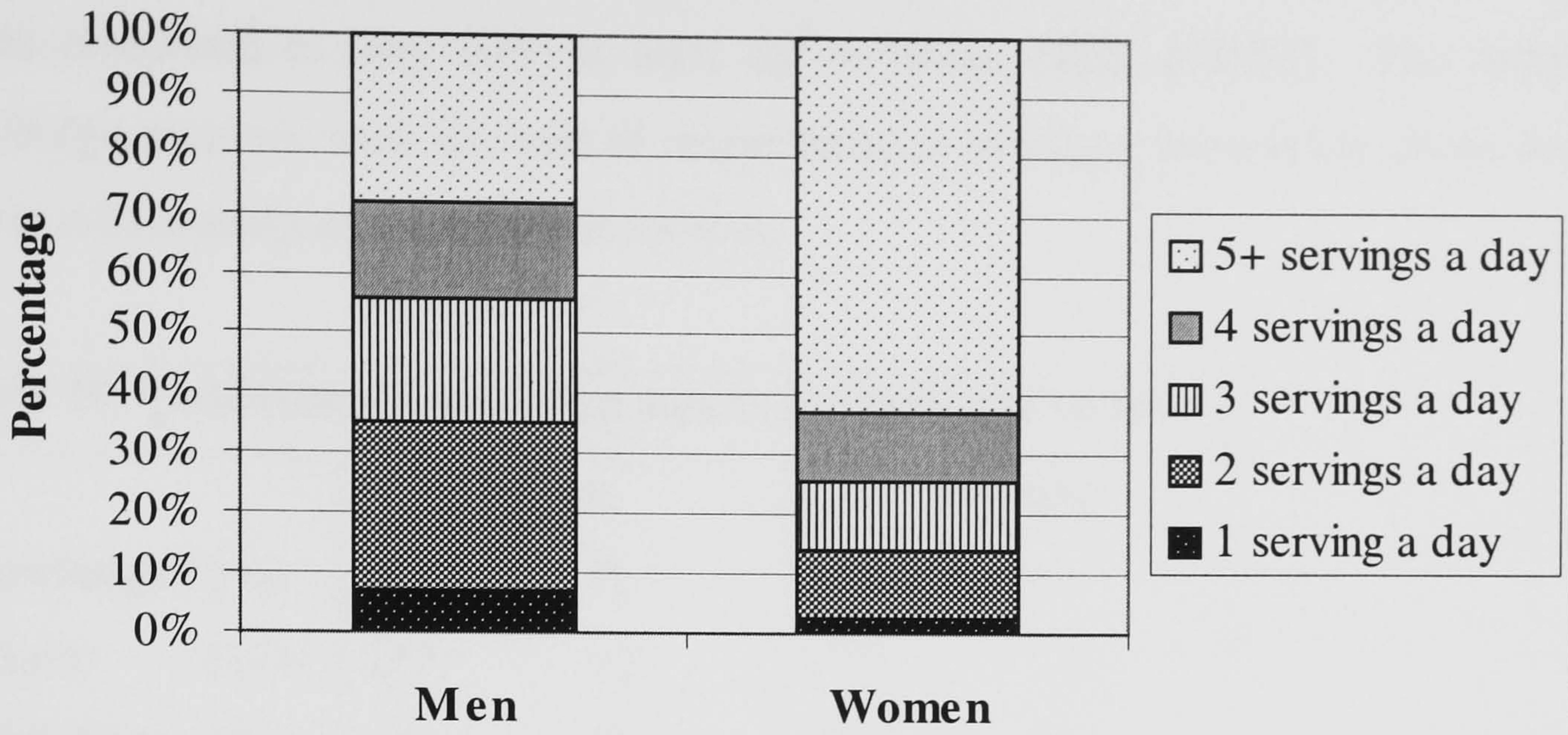
Table 15 Gender differences in correct perception of adequacy of intake

	Fruit		Vegetables	
	n	%	n	%
Men	244	54	217	46
Women	334	68	304	59

Gender differences in nutritional knowledge

There was a significant difference in estimates of recommended servings for fruit and vegetables between men and women (t = -10.75, df[955], p<0.01). Women estimated the recommended servings of fruit and vegetable servings at 4.53 (sd=1.56), compared with 3.43 (sd=1.59) for men. Also more women (63%) than men (28%) correctly estimated health recommended to be 5+ servings a day (χ^2 = 116.32, df[1], p<0.001), and displayed in Figure 4.

Figure 4 Gender differences in estimates of recommended servings



Significantly more women than men felt that they were aware of a relationship between diet and disease ($\chi^2 = 6.02$, df[1], $p<0.01$)

Table 16 Gender differences in awareness of diet and disease relationship

	Men		Women	
	n	%	n	%
Aware	131	28	174	35
Unaware	339	72	320	65

There were significant differences in estimations about nutrient content with women estimating higher levels of vitamins and fibre in both fruit and vegetables. Women significantly rated the vitamin content to be higher in fruit (χ^2 =25.75, df[3], $p<0.001$) and vegetables (χ^2 =29.51, df[3], $p<0.001$) and the fibre content to be higher in fruit (χ^2 =19.67, df[3], $p<0.001$) and vegetables (χ^2 =12.25 df[3], $p<0.001$) than men did.

Table 17 Estimated nutrient content for fruit and vegetables by gender (1 = very low – 4 = very high)

	Men		Women		
	Mean scores	**s.d.**	**Mean scores**	**s.d.**	**p**
Fruit					
Vitamins	3.13	0.49	3.28	0.48	0.00
Fibre	3.08	0.63	3.25	0.64	0.00
Vegetables					
Vitamins	3.14	0.51	3.32	0.50	0.00
Fibre	3.28	0.55	3.40	0.56	0.00

As expected there was also a significant difference in the overall nutritional knowledge of men and women. 29% of women scored correctly on all the nutritional knowledge factors compared to only 10% of men. (χ^2 = 79.82, df[2], p<0.01). The nutritional knowledge measure took account of recommended servings, knowledge about diet and disease relationship and nutritional content.

Table 18 Nutritional knowledge scores for men and women				
	Men		**Women**	
Knowledge (1-6)	**n**	%	**n**	%
Low (1-2)	230	52	127	28
Medium (3-4)	166	38	196	43
High (5-6)	10	43	134	29

Gender differences in attitudes

There were also significant differences in a number of the different attitudes to fruit and vegetables. The mean scores for these are presented in Table 19. Women were more positive about the taste (t [df=964] = -2.10, p<0.05) and convenience (t [df=966] = -3.42, p<0.01) of fruit, and also more positive about the ease of preparation (t [df=955] = -2.65, p<0.01), convenience (t [df=913] = -4.06, p<0.01) and taste of vegetables (t [df=957] = -2.47, p<0.05). However women were less positive about the price of fruit than men (t [df=937] = -2.77, p<0.01).

Table 19 Attitude differences by gender					
	Men		Women		
Attitudes to fruit (min 1-max 4)	**Mean scores**	**s.d.**	**Mean scores**	**s.d.**	**p**
Fruit tastes delicious	3.31	0.52	3.38	0.54	=0.36
Fruit is expensive	2.41	0.64	2.53	0.67	<0.001
Fruit makes a convenient snack	3.23	0.52	3.35	0.54	<0.001
Fruit does not keep very well	2.57	0.64	2.51	0.62	ns
Fruit is easy to prepare	3.22	0.48	3.29	0.51	ns
Good quality fruit can be bought at my local shops	3.07	0.55	3.09	0.62	ns
Attitudes to vegetables (min 1-max 4)					
Vegetables are easy to cook with	3.17	0.42	3.25	0.46	<0.001
Vegetables make a convenient snack	2.60	0.68	2.77	0.62	<0.001
Vegetables taste delicious	3.07	0.56	3.17	0.62	<0.001
Vegetables do not keep very well	2.39	0.62	2.43	0.64	ns
Vegetables are expensive	2.14	0.66	2.19	0.66	ns
Good quality vegetables can be bought at my local shops	3.06	0.56	3.09	0.61	ns

Socio-economic deprivation differences

Socio-economic derivation was indexed by car ownership and housing tenure. Participants who were both car and home owners were classified as low deprivation (80%), those who owned either a car or home were classified as medium deprivation (13%) and those who had neither were classified as high deprivation (7%). The majority of people had low levels of deprivation with only a small minority having high levels of socio-economic deprivation.

Intake

There were significant differences in total daily intake of fruit and vegetables. Those participants with higher levels of deprivation consumed fewer servings of fruit (Anova [df=2, 984], F=10.15, p<0.001) and vegetables (Anova [df=2, 983], F=11.45, p<0.001).

Attitudes

Higher deprivation participants also scored highest on the attitudinal factor about beliefs that vegetables are expensive (Anova [df=2, 899], F=7.92, p<0.01). There were no significant differences in other attitudes for either fruit or vegetables by economic deprivation.

Nutritional knowledge

There were significant differences in knowledge levels with a linear relationship between deprivation level and knowledge (Anova [df=2, 889], F=4.45, p<0.05). Participants with higher levels of deprivation scored lower on the overall nutritional knowledge measure.

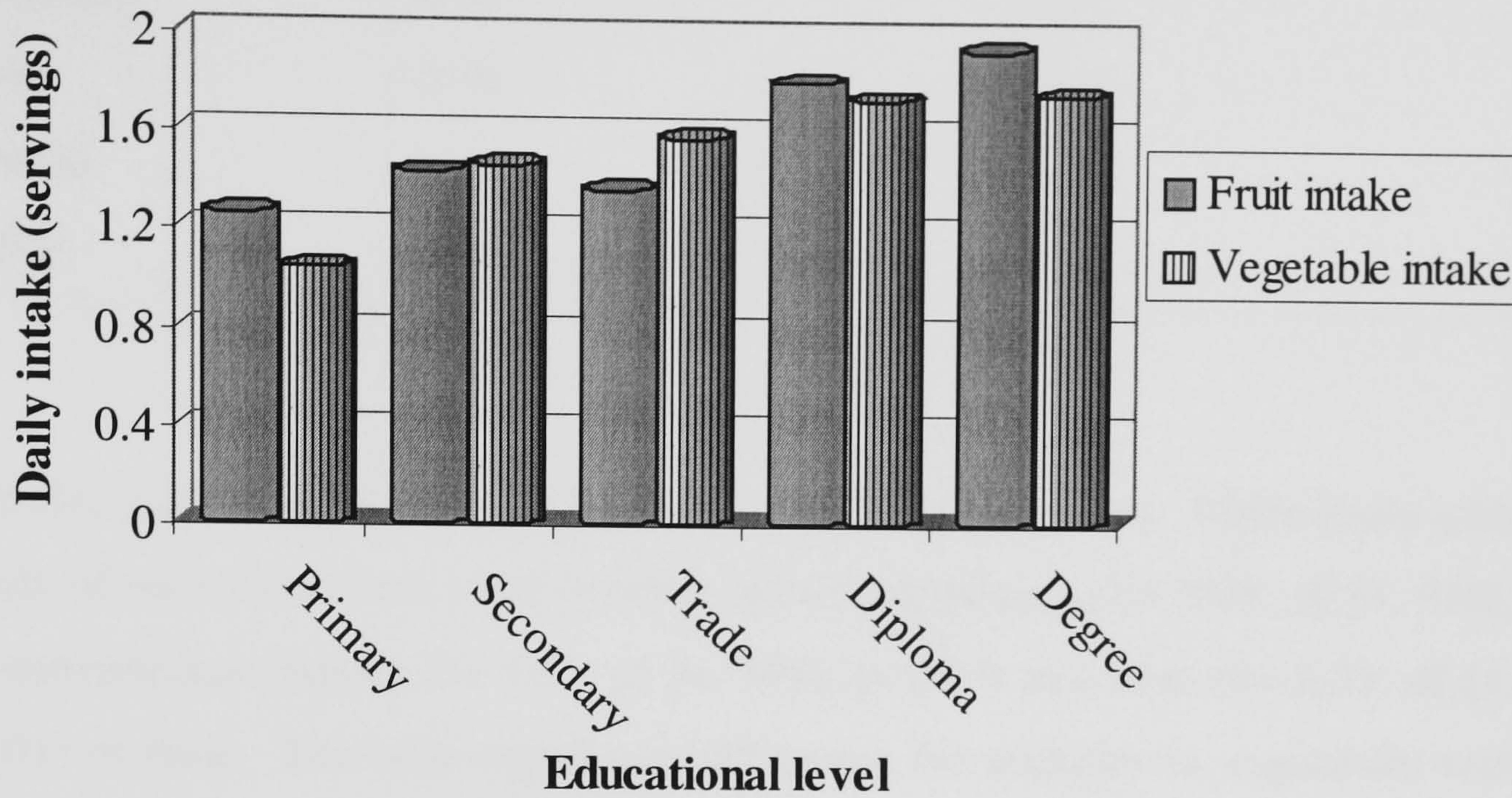
Table 20 displays values for intake, attitudes and knowledge by socio-economic deprivation level.

Table 20 Socio-economic deprivation differences

	High deprivation n=67		Medium deprivation n=133		Low deprivation n=801	
	Mean	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**
Daily fruit intake	0.99	1.13	1.40	1.37	1.58	1.10
Daily vegetable intake	0.86	0.90	1.59	1.43	1.54	1.20
Nutritional knowledge	4.52	0.65	4.70	0.73	4.82	0.79
Price of vegetables	2.41	0.82	2.29	0.74	2.12	0.62

Highest education level differences

Figure 5 Fruit and vegetable intake by highest educational level



Intake

There were significant difference in total daily intake of fruit (Anova [df=4, 971], F= 6.63, p<0.01) and vegetables (Anova [df=4, 970], F= 4.46, p<0.01). Participants with the highest level of education consumed the highest daily level of fruit and vegetables. There is linear relationship between highest educational levels and intake for total fruit and vegetables. See Figure 5.

Nutritional knowledge

Nutritional knowledge was also associated with educational levels with those with higher levels of education having higher levels of nutritional knowledge. Significantly more participants in the higher educational levels groups were aware of diseases related to fruit and vegetable consumption (χ^2 =83.83, df[4], p<0.001) (see Figure 7) and knew about the 5 a day recommended level (χ^2 =8.82, df[4], p<0.05) (see Figure 8). See Table 21 for overall nutritional knowledge scores.

Table 21 Nutritional knowledge by highest educational level		
	Mean	**s.d.**
Primary	4.26	0.72
Secondary	4.70	0.73
Trade	4.78	0.78
Diploma	5.14	0.77
Degree	5.07	0.81

Attitudes

There were also some significant attitudinal differences by education. Participants with higher levels of education were more positive about preparation (F= 6.09, df [4, 938], $p<0.001$), convenience (Anova F= 3.21, df [4, 948], $p<0.05$) and taste (F= 4.51, df [4, 945], $p<0.01$) of fruit. The only significant difference for attitudes to vegetables was the perceived expense of vegetables with those participants with lower educational levels rating vegetables as more expensive (F= 2.85, df [4, 888], $p<0.05$).

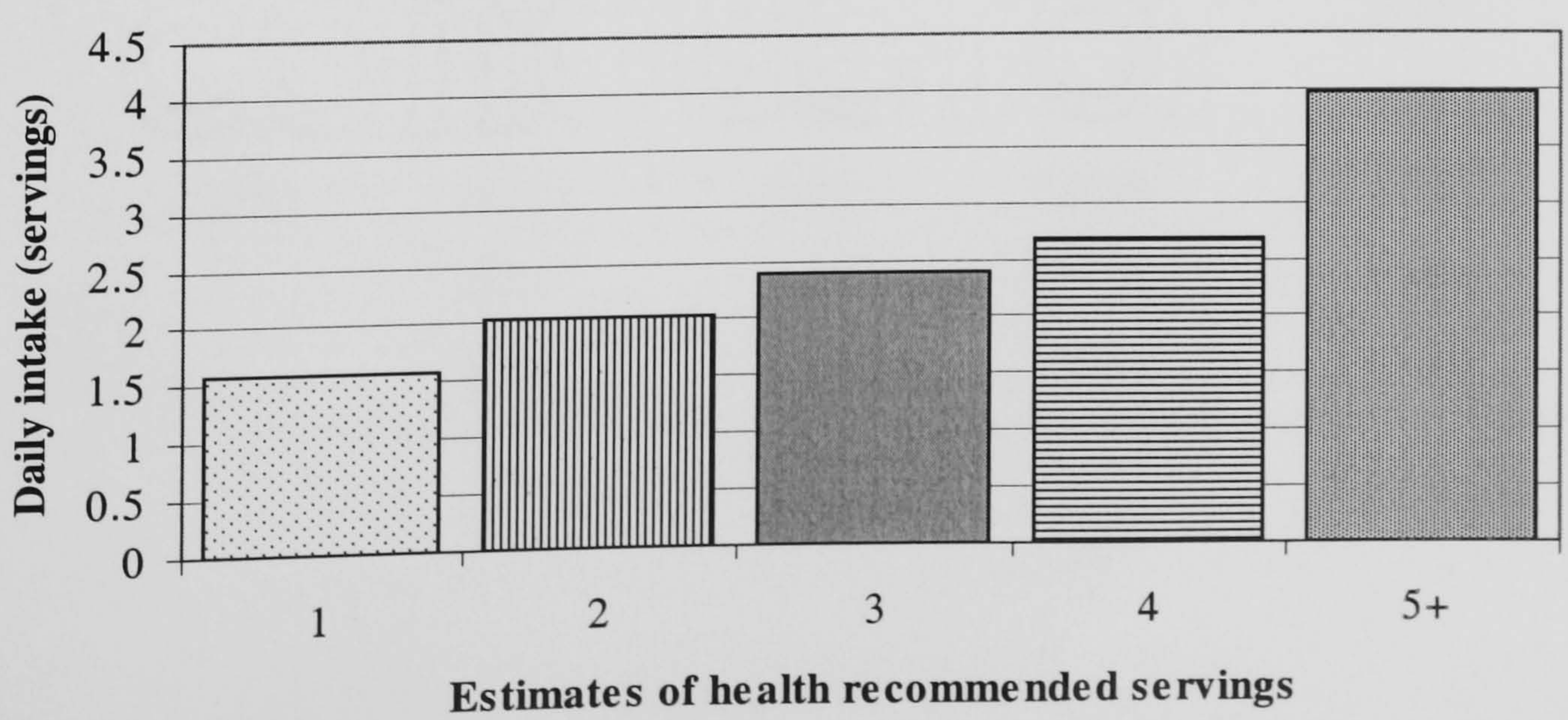
Psychological predictors of fruit and vegetable intake

Nutritional knowledge

Recommended servings

Recommended servings of fruit and vegetables correlated highly with actual intake ($r_s = 0.34$, $p<0.001$). See Figure 6. There is a linear relationship between the amount participants believe health experts recommend for daily fruit and vegetables and total daily intake of fruit and vegetables.

Figure 6 Daily intake of fruit and vegetables by estimated health recommended servings



Knowledge of diet and disease relationship

There were significant differences in mean intake for those who were aware of a relationship between diet and disease and those who were not ($t = -5.22$, df[961], $p < 0.001$). Participants who were aware of major diseases related to fruit and vegetable consumed 3.51 servings a day whilst those who did not consumed 2.83 servings.

Nutrient content

The estimated nutrient content of fruit and vegetables significantly correlated with intake. Fruit intake was significantly correlated with rating of fibre ($r_s = 0.15$, $p<0.001$) and vitamins ($r_s = 0.15$, $p<0.001$), and vegetable intake was significantly correlated with rating of fibre ($r_s = 0.13$, $p<0.001$) and vitamins ($r_s = 0.14$, $p<0.001$). This indicates that those people who believe that fruit and vegetables are high in important nutrients eat more of them.

Attitudes

Using a Spearman's correlation to look at the association between different attitudes and behaviour revealed significant correlations between attitudes to fruit and vegetables and intake (0.08-0.31). The only attitude which was not significantly correlated with intake was the price of fruit. This would suggest that attitudes are associated with behaviour, although they could mediate or be mediated by other psychological factors which will be discussed later on. See Table 22.

Table 22 Correlations between attitudes and fruit and vegetable intake

	fruit		**vegetables**	
Attitudes	r_s	p<	r_s	p<
Preparation	0.21	0.001	0.15	0.001
Price	0.01	ns	0.12	0.001
Convenience	0.25	0.001	0.13	0.001
Availability	0.08	0.05	0.10	0.001
Taste	0.31	0.001	0.22	0.001
Storage	0.09	0.001	0.11	0.001

Multivariate analysis

Predictors of intake

Multivariate analysis was conducted to look at the predictors of fruit intake. Multiple regressions included demographic characteristics, nutritional knowledge and attitudinal factors as dependent variables. Independent effects of the three blocks of variables are shown in Table 23. Demographic characteristics alone account for 8%, nutritional knowledge alone accounts for 12% and attitudinal factors alone account for 9% of the variance in intake of fruit independently. Of the attitudinal factors only perceived ease of storage and taste were significant predictors of intake, although ease of preparation was marginally significant.

Table 23 Demographic characteristics, nutritional knowledge and attitudes as independent predictors of fruit intake (3 separate analyses)

	Beta	p<
Demographics		
Adjusted R Square = 0.8		
Gender	0.24	0.001
Economic deprivation	0.08	0.01
Qualification	0.15	0.001
Nutritional knowledge		
Adjusted R Square = 0.12	0.35	0.001
Attitudes		
Adjusted R Square = 0.9		
Storage	-0.11	0.001
Preparation	0.07	0.08
Price	0.003	ns
Quality	-0.04	ns
Convenience	0.05	ns
Taste	0.22	0.001

A hierarchical regression was conducted in three stages to look at the impact of demographic factors, knowledge and attitudes on intake of fruit and vegetables consecutively. This was conducted to assess the mediating role of knowledge and attitudes in explaining demographic characteristic differences. Gender, education and economic deprivation level accounted for 8% (Adjusted R^2 0.08) of the variance in fruit intake, all having independent effects. When nutritional knowledge was added to the equation a further 6% of variance was explained (Adjusted R^2 0.14). Economic deprivation level was no longer significant, and also the effect of education was reduced (Beta 0.15 reduced to 0.07) as was the effect of gender (Beta 0.24 reduced to 0.14) suggesting that knowledge mediates some of the effect of economic deprivation, education, and gender on intake (see Table 24). Finally when individual attitudinal factors related to fruit were added as well, this accounted for an additional 6% of the variance with 20% of the variance overall now being explained (Adjusted R^2 0.20). Only the attitudinal factor about perceived taste of fruit was significant. Economic deprivation level and education became non-significant when attitudes were added to the model (see Table 25). Therefore the perception of taste of fruit might mediate some economic and educational variation in fruit intake. However attitudes did not have any significant impact on the effect of gender on behaviour.

Table 24 Demographic and nutritional knowledge as predictors of fruit intake

Variable Df [4, 862]	**Beta**	**p<**
Demographics		
Gender	0.14	0.001
Economic deprivation	0.05	ns
Educational level	0.07	0.05
Nutritional knowledge	0.29	0.001

In the final model gender, nutritional knowledge and attitudes were all independent predictors of fruit intake.

Table 25 Demographic, knowledge and attitudinal factors as predictors of fruit intake		
Variable Df [10, 797]	**Beta**	**p<**
Demographics		
Gender	0.12	0.001
Economic deprivation	0.05	ns
Qualification	0.05	ns
Nutritional knowledge	0.26	0.001
Attitudinal factors		
Storage	-0.04	ns
Preparation	0.03	ns
Price	-0.02	ns
Quality	-0.04	ns
Convenience	0.03	ns
Taste	0.21	0.001

The same analysis was conducted for intake of vegetables. Independent effects of the three blocks of variables can be seen in Table 25. Demographic characteristics accounting for 6%, nutritional knowledge accounting for 7% and attitudinal factors accounting for 6% of the variance. Of the attitudinal factors only perceived ease of storage and taste were significant predictors, although perceived expense was marginally significant.

Table 26 Demographic characteristics, nutritional knowledge and attitudes as independent predictors of vegetables intake (3 separate analysis)		
	Beta	**p<**
Demographics		
Adjusted R Square = 0.6		
Gender	0.20	0.001
Economic deprivation	0.12	0.001
Qualification	0.12	0.001
Nutritional knowledge	0.27	0.001
Adjusted R Square = 0.7		
Attitudes		
Adjusted R Square = 0.6		
Storage	-0.11	0.01
Preparation	0.06	ns
Price	0.06	0.1
Quality	-0.03	ns
Convenience	0.04	ns
Taste	0.17	0.001

As before, a hierarchical regression was conducted in three stages to look at the impact of demographic factors, knowledge and attitudes on intake of vegetables consecutively. Gender, education and economic deprivation accounted for 6% (Adjusted R^2 0.06) of the variance in vegetable intake. When nutritional knowledge was added to the equation a further 4% of variance was explained (Adjusted R^2 0.10), and the effect of education was no longer significant (see Table 27) and also the effect of gender (Beta 0.20 reduced to 0.14) was reduced slightly. Finally when attitudes to vegetables were added, this accounted for an additional 5% of the variance with 15% of the variance now being explained (Adjusted R^2 0.15). The attitudinal factors about perceived taste of vegetables, perceived easy of cooking and ease of storage were significant (see Table 28). There was no further reduction in amount of variance explained by the demographic factors.

Table 27 Demographic and nutritional knowledge as predictors of vegetable intake		
Variable Df [4, 862]	**Beta**	**p<**
Demographics		
Gender	0.14	0.001
Economic deprivation	0.10	0.01
Educational level	0.05	ns
Nutritional knowledge	0.20	0.001

Table 28 Demographic, knowledge and attitudinal factors as predictors of vegetable intake		
Variable Df [10, 746]	**Beta**	**p<**
Demographics		
Gender	0.16	0.001
Economic deprivation	0.11	0.01
Educational level	0.05	ns
Nutritional knowledge	0.17	0.001
Attitudinal factors		
Storage	-0.13	0.001
Preparation	0.08	0.05
Price	-0.04	ns
Quality	-0.04	ns
Convenience	0.01	ns
Taste	0.12	0.01

In the final model gender, economic deprivation, nutritional knowledge and attitudes were all independent predictors of vegetable intake.

Summary of results

This study looked at the role of knowledge and attitudes on consumption of fruit and vegetables. The results indicate that the majority of people are not consuming adequate amounts of fruit and vegetables, in particular men, those with lower educational levels, and with higher levels of economic deprivation. These groups were also found to have lower nutritional knowledge measures and have less positive attitude to both fruit and vegetables. As well as this, it was found that both knowledge and attitudes were associated with intake.

Further analysis showed that the differences in intake levels by demographic factors could be partly explained by differences in nutritional knowledge in these groups. However attitudes were not found to mediate the impact of knowledge as might have been expected. Therefore both of these cognitions are important factors associated with dietary behaviour

Discussion

This chapter was concerned with both cognitions (knowledge and attitudes) and behaviour (intake) in a sample of adults attending for cancer screening. The purpose of this part of the study was first to investigate levels of fruit and vegetables intake, nutritional knowledge and attitudes, and to look at associations with demographic characteristics, and secondly to examine the associations between cognitions and behaviour, particularly to see whether knowledge and attitudes have independent associations, or attitudes mediate the effect of knowledge.

The literature on the association between knowledge and behaviour has produced varied results. Some studies have found little or no association between knowledge and behaviour (Axelson et al, 1985; Shepherd and Towler, 1992), while other studies have indicated that there is a strong relationship (Parmenter and Wardle, 1999). One possible factor is the measures used and Parmenter and Wardle have argued that many studies have used poor measures of nutrition knowledge. In addition most of the studies carried out have focused on intake of fat or fibre and how knowledge relates to this, and it can not be assumed that the association would be the same for fruit and vegetable intake, since some of the recommendations are much more recent.

Associations between attitudes and dietary behaviour have emerged more consistently in the literature. People who have greater perceived negative attitudes consume fewer servings of fruit and vegetables (Cox et al, 1996). Few studies have measured both knowledge and attitudes, so there have been little attempt to see if attitudes mediate the impact of knowledge on behaviour. As well as this a greater understanding is needed of the differences in behaviour by gender, education and SES.

Participants in this study completed questionnaires whilst attending for bowel cancer screening. All participants were aged between 55 and 65 years of age and taking part in a national clinical trial.

The reasons why this study has only focused on fruit and vegetable intake is because of the plethora of research which has shown that consumption of this food type is important to development of the major diseases of cancer and heart disease (WCRF, 1997), but also the apparent low levels of intake identified in a number of studies (Nutritional Survey, 1990, National Food Survey, 1996). There is a dearth of research which has examined why this might be. At the time of this study there had recently been a lot of focus in the media on the need to eat more fruit and vegetables, and the '5 a day' message. Many of these campaigns had been carried out without proper evaluation of the impact on the general public.

Initial findings from this study suggest that this sample of participants consumed significantly fewer servings of fruit and vegetables than the 5 servings or 400 grammes a day recommended by the World Health Organisation (1990). The average combined intake levels in this sample were found to be approximately three servings a day, which is 40% less than the recommended level. The results are in line with other investigations of fruit and vegetable intake in the UK such as the Nutritional Survey of British Adults (1990) and the National Food Survey (1994) which found intake levels for the population to be approximately 2.5 servings combined for fruit and vegetables a day. The slightly higher intake level found in this study than in other general population investigations, may be because of the recent time scale of this study and possible changing intake levels in the population or the age group of this sample. The 1978 Household Consumption Survey carried out by MAFF found that adults aged 55-64 years consumed 1.4 times as much fresh vegetables and 1.25 times as much fruit as the average adult intake.

Although mean intake levels are one method of assessing intake, another method is to look at the proportion of people who are consuming the recommended amounts. In this sample only a minority (21%) were consuming the recommended quantities of fruit and vegetables. Therefore it may be that whilst mean intake levels of the population as a whole tell us that people eat 40% less than recommended, in fact we can see that only a fifth of people meet the recommended level. This has implications for addressing the low levels of intake in the majority of the sample. Should programs target those people who are consuming fewer servings or everybody in general to raise the average intake levels?

While it is apparent that these groups as a whole were not consuming adequate amounts, this does not tell us who are most at risk or why this may be. Research in the past has suggested that men consume fewer servings of fruit and vegetables than women (Milligan, Burke, Beilin, Dunbar, Spencer, Balde and Gracey, 1998 and McClelland, Demark-Wahnefried, Mustian, Cowan, and Campbell *et al,* 1998) and also that people with lower SES consume fewer servings than higher SES groups (Milligan *et al,* 1998). In this study women were found to consume approximately one serving more than men, and people with lower SES levels consumed more than one servings less than people from high SES. The results confirm previous findings on individual characteristic differences, and suggest that men and lower SES groups need to be targeted in dietary interventions. Before this is done it is important to establish why these groups are consuming fewer servings of fruit and vegetables. Women have been found to consume healthier diets than men overall and fruit and vegetable intake is just one aspect of dietary status, although that is not of course any explanation. Women tend to have a greater interest in healthy diets, a desire to eat food lower in calories (Rolls, Fedoroff and Guthrie, 1991) and also have a different lifestyle to men which may be more conducive to eating fruit and vegetables. The pressure to be thin may be one of the reasons why women consume foods that have lower calorie content. There are also clear differences in the utilisation of health services with more women attending for medical care (ONS, 2000) than men, which suggests that women are more interested in their overall health. Participants from lower SES groups also consumed less fruit and vegetables. SES is an indicator for many different factors and is also likely to be related to educational levels, deprivation, disposable income, but also to a different lifestyle. The reasons why participants from lower SES groups consume fewer servings than those from higher SES groups could be dependent on these indicators. Those participants with high levels of deprivation are more disadvantaged in their dietary behaviour, possibly due to economic limitations or other psychological reasons associated with their lifestyle. However it is also possible that gender and SES differences are related to differences in cognitive factors such as knowledge and attitudes.

Variations in nutritional knowledge are one possible cause of variations in intake. The many studies of nutritional knowledge carried out, consistently find that knowledge levels are low. In this study only nutritional knowledge relating to fruit and vegetable intake was investigated. Participants were asked questions about knowledge of recommended levels, awareness about links between fruit and vegetables and disease and knowledge about the nutrient content of fruit and vegetables. These factors were chosen to reflect the basic knowledge necessary to make appropriate food choices. Questions were taken from the standardised Nutritional Knowledge Questionnaire (Parmenter and Wardle, 1999), and were designed to give participants the option to guess or not complete if they did not know. Nutritional knowledge overall was found to be poor in this sample. Surprisingly, fewer than half of the participants were aware of health experts recommendations to eat at least 5 servings of fruit and vegetables a day, which compares with the other UK study by Parmenter and Wardle (1999) which found that approximately 30% of their representative sample were aware of the 5 a day message. Although the level in our study were higher than in this study, the results still indicate the low numbers of people aware of recommendations even in this selective sample. This is somewhat surprising taking into consideration the recent mass media campaigns to promote the '5 a day' message by the British Dietetic Association (1998, 1999), British Heart Foundation (1998) and the Food and Drink Federation (1998), which therefore appear to have not had significant or lasting impact in this sample. The possible problems with these mass media campaigns are that they are targeting the wrong people or otherwise the generic nature of the message may mean that people do not believe it applies to them. Nevertheless assumption that 'everybody' is aware of this basic message are questioned somewhat.

Other questions relating to nutritional knowledge found similar levels of ignorance. Fewer than a third of the sample knew of any diseases or health problems relating to intake of fruit and vegetables, which is even lower than the numbers aware in other studies (Parmenter et al, 2000). Participants were asked *'do you know of any major health problems or disease that are related to either a high or low intake of fruit and vegetables?'*. The levels are especially low when we consider the broad nature of the question and it suggests that the specific links between fruit and vegetables and cancer and heart disease are likely to be known by even fewer people. The results indicate that headlines in national newspapers such as 'Frozen veg can prevent cancer cases' (Telegraph, 1996), 'Eating up your greens could save your life' (Telegraph, 1997) and 'Eating to avoid bowel cancer' (Telegraph, 1999) appear to have had little impact on knowledge. Participants were also asked about the nutrient content of fruit and vegetables. The majority of people estimated fruit and vegetables to have high levels of vitamins and fibre. When the answers to individual questions were collated together, only 19% of the sample correctly answered all the items measured on the composite, 6 item, nutritional knowledge scale. As this was a sample which was concerned about health, it suggests very poor levels of basic nutritional knowledge in the general population.

Presently the media is the main source of information about fruit and vegetables. However it has already been noted that large media campaigns to promote recommendations and health benefits of intake are falling on deaf ears. It may be that media information is being inappropriately directed, not achieving target audiences, set at the wrong levels or giving the wrong messages. There is a common assumption that people know what they should be eating and why, and fail to make changes due to other factors such as lack of motivation or perceived barriers. The results of this study show that many people were unaware of basic dietary recommendations. Interventions to change dietary behaviour should take into consideration that people may not feel that they need to make dietary changes because of lack of knowledge not through informed choice.

Despite widely publicised professional opinion, the majority of participants in this study believed they were eating sufficient amounts of both fruit and vegetables. This inaccurate perception could be down to a lack of knowledge, whereby people assume they are eating adequate amounts because they are consuming what they believe to be the recommended level. If people believe the amount of fruit and vegetables they eat is about right then they are unlikely to make the necessary change to their behaviour.

As with dietary behaviour, it was important to establish whether there were individual characteristics which differentiated people in their levels of nutritional knowledge. As expected there were large differences in level of nutrition knowledge between men and women. More than twice the number of women compared to men knew about recommendations for 5 servings of fruit and vegetables a day. Also more women knew about the relationship between diet and disease, and more women correctly estimated the nutrient content for fruit and vegetables. Overall women scored better on all the nutritional knowledge measures than men with 29% aware of all the factors measured compared to 10% of men. This replicates the other studies which have found gender differences in levels of nutritional knowledge (Crawford & Baghurst, 1990; Parmenter et al, 2000), with women having greater nutritional knowledge than men. Although these studies have highlighted gender differences in knowledge, they do not offer substantial explanation as to why this may occur and the subsequent impact on behaviour. There appears to be no apparent shift in the gender differences in knowledge over the past ten years, with men still having even poorer levels. One possible reason why women have greater knowledge is the methods and places that information about diet and health are targeted. The major sources for nutritional information are the supermarket, health care settings such as GP surgeries and the media. More women attend supermarkets and GP clinics (General Household Survey, 1994) than men do. Also men tend to be less interested in the health or taste aspects of food (Roininen, Lahteenmaki and Tuorila, 1999) so the information may be less salient to them. Perhaps the recent development of men's magazines about health may see a change in knowledge and interest. However until research is carried out to find out where people acquire knowledge from then little is going to be known about why these gender differences occur. Research in the future should look at the impact of information provision on male dietary behaviour.

The other cognitive factor which has been shown to be consistently associated with behaviour are attitudes. Attitudes are often measured in attempt to find out why people behave in a certain way. The links between knowledge and attitudes and behaviour have found differing degrees of strength. Overall assessment of different attitudes found that the majority of participants had positive attitudes as measured around the midpoint. Participants were asked whether they agreed with statements about 'price', 'convenience', 'availability', 'storage', 'taste' and 'preparation' of fruit and vegetables. Of these factors there were concerns about the price and storage of fruit and vegetables. The purpose of assessing different attitudes was to see if particular attitudes were associated with behaviour and therefore explain variations in behaviour. As with knowledge, there were also differences in attitudes ratings by gender. Women tended to have more positive attitudes to fruit and vegetables especially about the taste and convenience. Women however also rated vegetables as more expensive than men did. This may be a consequence of women in this age group being the main food shoppers in the family and also making the decisions about what food it bought. The differences between women and men in both behavioural and key psychological factors imply that these may be connected.

Research in the past has shown that attitudes are significantly related to dietary behaviour (Shepherd and Towler, 1992), with people who have more negative attitudes being less likely to perform certain behaviours. The evidence for an association between knowledge and behaviour is not so clear cut, with some research in the past (Axelson et al, 1985; Shepherd & Stockley, 1987) suggesting that there may not be a strong relationship between general nutritional knowledge and eating behaviour, although it has been found more recently that (Parmenter & Wardle, 1999) specific nutritional knowledge can be strongly related to specific eating behaviour. Further to this the literature rarely looks at the interaction of knowledge and attitudes on behaviour, or the role these play in accounting for possible demographic differences. In this study nutritional knowledge, specific to fruit and vegetables was investigated. Nutritional knowledge was found to be consistently correlated with intake of fruit and vegetables for all the knowledge factors investigated. Therefore participants who were aware of recommended levels, knew about the links between diet and disease and also knew about the nutrient content were more likely to consume more fruit and vegetables. Of the knowledge items asked, recommended levels was found to be most strongly correlated with intake. Therefore not being aware of requirements, benefits and nutrient content may be one reason why fruit and vegetables are not selected as much as they should be. Whilst people need to have the tools to make change, education can be used to encourage and motivate change. Knowledge seems to be strongly associated with behaviour when the knowledge is specific to the behaviour being assessed. Behavioural goals are especially important in the change process. Gebhardt (1997) who used the health behaviour goal model argues that behaviour change is a goal-oriented action, so if people don't know what they should do, there is little chance of them doing it. Therefore making people aware of the basic recommendations is the most important knowledge factor to raise.

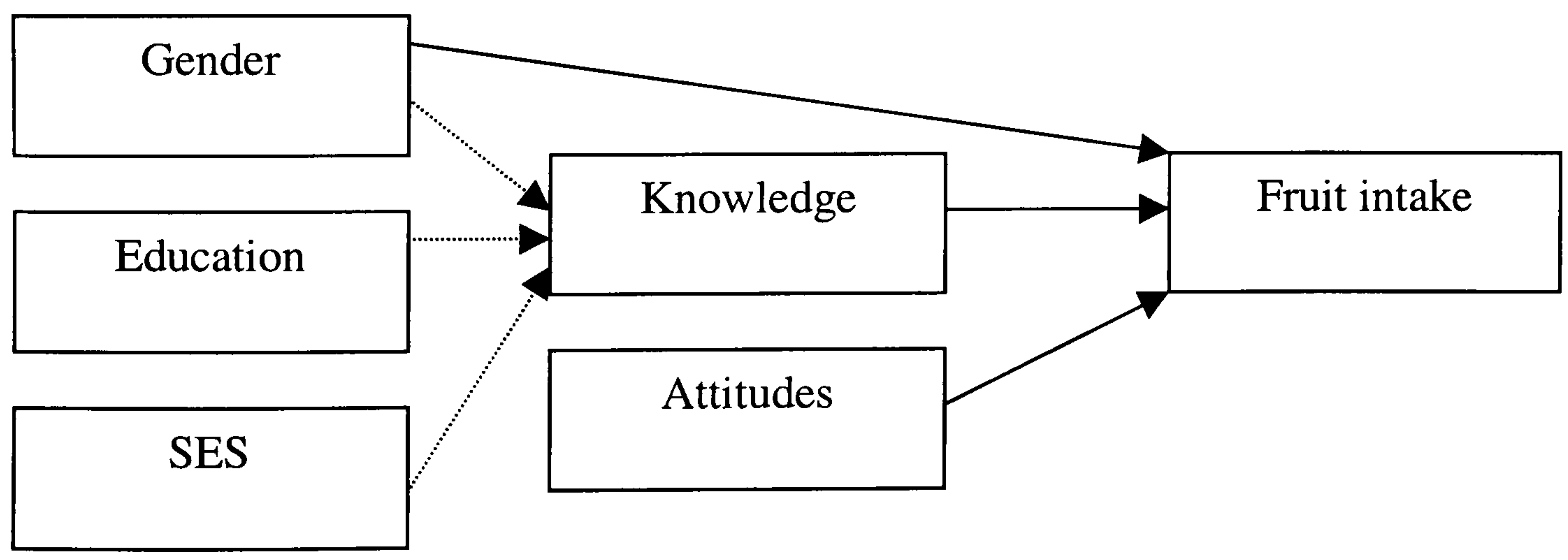
There were also significant correlations between attitudes and behaviour for fruit and vegetables as expected. All of the attitudinal factors were significant for fruit and vegetables apart from the price of fruit. One plausible reason for this may be that whilst people believe fruit is expensive it does not affect their consumption of it. This may be true because more than half of participants agreed that fruit was expensive even though some of these consumed adequate levels. Those people who had more positive attitudes overall consumed more fruit and vegetables. The strongest association between attitudes and behaviour was *taste* for both fruit and vegetables suggesting that hedonic responses are major concern above and beyond practical beliefs. This support previous work by Shepherd (1990) who found that taste was more important than items such as price and convenience for food choice. Thus people are not likely to consume food that they do not like the taste of, even if it is cheaper, easier to keep and more available.

Correlation coefficients between attitudes and behaviour (r = 0.08-0.31) and knowledge and behaviour were similar (r= 0.13-0.34), dependent on the different aspects being measured.

The results so far show that as hypothesised knowledge and attitudes are both associated with behaviour. However this does not tell us much about how these factors interact with demographic influences on behaviour, or whether attitudes intervene between knowledge and behaviour as found by Grotkowski et al (1978).

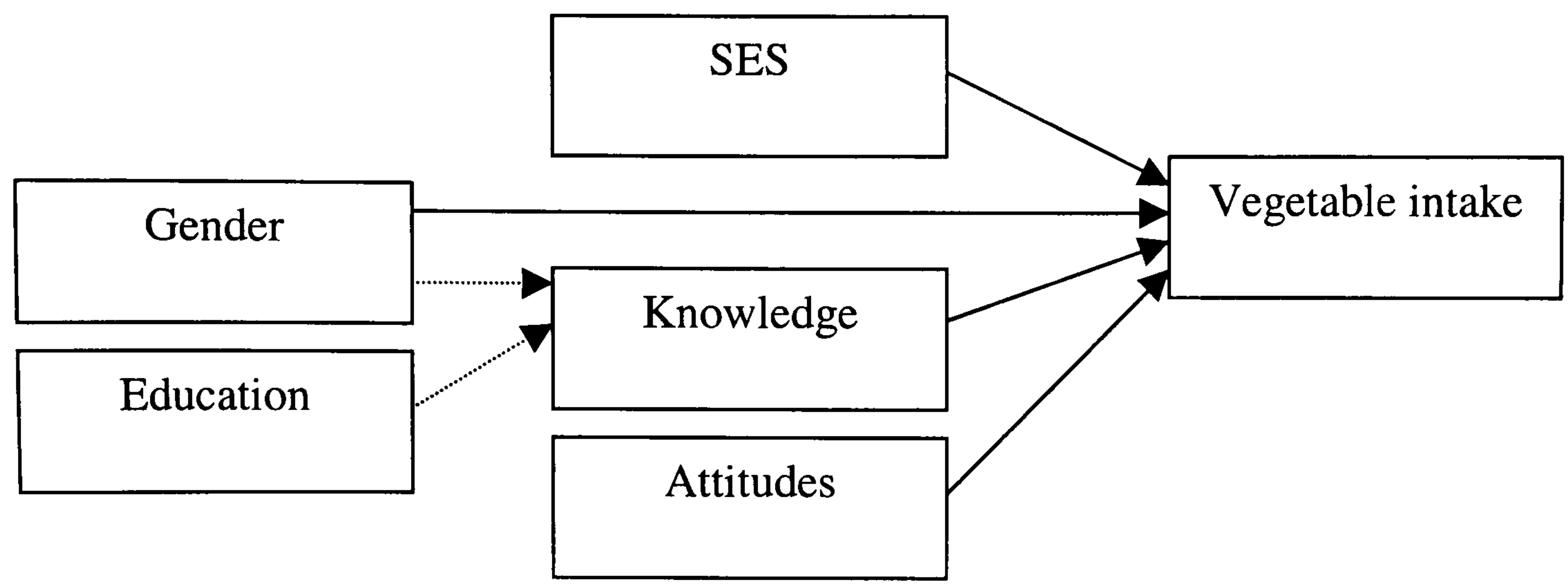
Multivariate analysis showed knowledge mediates the effect of both education and socio-economic status, and to some extent gender on level on fruit intake. Thus one of the reasons why these groups consume less fruit is because of lower levels of knowledge. As well as this perceived taste of fruit mediated the effect of educational level and socio-economic levels suggesting that these groups believe fruit does not taste as good as those with better education and higher SES. (see Figure 7).

Figure 7 Demographic, Knowledge and Attitudinal influences on fruit intake



Predictors of vegetable intake were investigated separately. There were some similar patterns found for vegetable intake with nutritional knowledge mediating the effect of educational levels on intake and gender somewhat, although attitudes did not mediate any factors. SES however had only a direct effect. Different attitudes were found to be prominent for fruit and vegetables. Fruit intake was only predicted by taste, whilst for vegetable intake, taste, storage and preparation were all significant predictors.

Figure 8 Demographic, Knowledge and Attitude influences on vegetable intake



Both of these models indicate the importance of knowledge and certain attitudes on behaviour which contradicts the work by Shepherd and Stockley (1987) and Grotkowski et al (1978) suggesting that if knowledge has an impact on behaviour, it is through attitudes. Knowledge is found to have as strong an effect on intake as do attitudes. It is evident from this research that certain types of knowledge are more important to subsequent behaviours than others. The tendency in the past was to look at general levels of nutritional knowledge in relationship to specific behaviours which did not necessarily find strong associations. However this study which uses nutritional knowledge specific to the behaviour being addressed found that this was a significant predictor of intake, as were attitudes.

The reasons for demographic variation in knowledge and attitudes could be due to a number of reasons. People with less educational level or SES may not have access to the sources of information about fruit and vegetables. Additionally some information may be given at educational establishments although this is unlikely. More likely is the idea that people with better education are able to read and understand information from a wider variety of sources, which they can use to guide their lifestyles. Social economic differences might reflect the influences of different lifestyles on exposure and acceptance to such information.

The results also show that gender is clearly an important predictor in this analysis and the reasons why intake levels for men and women differ can not be explained by differences in knowledge and attitudes alone. Thus further work is needed to establish what factors whether they be psychological or not, explain the variations in behaviour by gender.

Only between 15 and 20% of the variance in intake was explained by knowledge or attitudes which indicates that there are other important factors which influence food choices not measured here. It is likely that the relatively limited number of attitudinal items investigated may mean that there other attitude factors are more important to eating behaviour. The results support our hypothesis that knowledge and attitudes effect behaviour. These factors are important predictors of low and high intake and effect other predictors such as gender, educational level and socio-economic level. The research would benefit from further work to ascertain why the large gender differences occur.

There were some methodological limitations of the baseline study which need to be taken into account in interpreting the results. These mainly focus on the sample and measures used for investigation. The high response level (84%) achieved, indicates that collecting information on diet and health in a cancer-screening setting is advantageous, possibly as a consequence of the salient setting. Participants may have felt obligated to complete the questionnaires because they had just received a screening test or were probably more health concerned. At the time the test was not offered to all people of that age group in the population as standard, so participants may have felt especially grateful. The age range of this sample (55-65 years) may have also contributed to this high response rate. Nevertheless although the response rate was high it is important to realise that this sample is unlikely to be representative of the population by virtue of their age and the nature of the setting. The probable higher levels of interest in health mean that the sample are likely to consume more, have more knowledge and care more than average. However looking at the results in comparison to previous studies on intake, knowledge and attitudes, this does not appear to hold true.

The specific age of the sample (55-65years) may also have implications for the results. This older sample are more likely to have established beliefs and behaviours which may be difficult to alter. The nutritional information publicised is not aimed at older adults so may seem inappropriate. Lastly the sample is likely to be a more homogeneous group due to the defined age, therefore meaning a possible lack of variety in their habits. Further work on another more representative sample would be useful in showing whether the findings are replicable especially in different age groups.

The types of questions used in this study were brief and uncomplicated. This was done to enable a variety of different topics to be investigated in a short period of time. The limited number of questions asked on attitudes and knowledge could be one reason why more of the variance was not explained.

Behaviour was assessed with a brief measure of intake, based on self-reported frequency of fruit and vegetable intake, as this could be completed instantly by participants. Some research has suggested that this fairly crude method of measuring dietary intake which may lead to over reporting (Cox et al, 1996). However more recent research (Marcus et al, 1998) suggest that it is a viable method to use as long as the results are treated with caution. The levels of intake identified in this study using this method were found to be comparable with other surveys using more in-depth measuring tools. Therefore we are able to conclude that this brief measure of analysis was fairly robust and representative in assessing daily intake level for fruit and vegetables. For the purpose of this study, behaviour was assessed primarily in relation to other factors so relationships that exist would not be effected by this issue.

Although there are some minor methodological issues to consider, which may affect whether the results can be generalised, the indications are promising. Participants with lower nutritional knowledge tend to have lower intake, as do participants with less positive attitudes. Therefore we can predict that increasing knowledge and improving positive attitudes could result in increased consumption of fruit and vegetables.

The findings from this sample support the research hypothesis that both knowledge and attitudes are independently associated with dietary behaviour. It is now important to establish whether these results can be replicated in other samples and also to see if the information gained can be used to change behaviour. The clear associations between nutritional knowledge, attitudes and behaviour in this study indicate that these are important factors to consider in intervention studies. Wide-scale public health messages about fruit and vegetable intake do not seem to be having an impact at the individual level as shown by the low intake, poor basic nutrition knowledge and negative attitudes held by large number of participants.

In a cross-sectional study such as this, correlation can not be distinguished from causation, but it seems plausible that both knowledge and attitudes influence subsequent behaviour. This will be further investigated in the next study, which uses an intervention design to modify knowledge and attitudes and thereby to modify intake.

Chapter 4 Readiness to change fruit and vegetable intake: intention and interest

Introduction

The work described in the previous chapter looked at the association of attitudes and knowledge with fruit and vegetable intake. In this chapter the focus is on factors associated with intention to change eating behaviour and interest in receiving more information about adopting a healthy diet. It is important to identify factors that may predispose some individuals to view change more positively. Intention represents an individual's conscious plan or decision to make an effort to perform a behaviour (Conner & Sparks, 1996) based on their motivation to do so.

The theory of planned behaviour (Ajzen and Madden, 1986) looks at the role of self-efficacy, attitudes and social norms as predictors of intentions to change, which in turn is consistently found to be associated with attempts to change a variety of behaviours. Intention to change dietary behaviour has been closely examined in the past decade in the context of this theory. The major constructs of the Theory of Planned Behaviour are attitudes towards a behaviour, subjective norm, perceived control and behavioural intention. Attitudes towards a behaviour are beliefs about an outcome and the evaluation of the outcome. These can be perceived benefits and/or practical barriers to performing a behaviour. Subjective norms are concerned with the beliefs about important others and also the motivation to comply with a specific behaviour. Although subjective norms have been used considerably in the context of weight loss where the role of important others is significant to change, they are perhaps the weakest predictor of intention and behaviour in food choice (Oygard & Rise, 1996). Perceived control concerns beliefs about ability to perform a particular behaviour. This can involve a variety of issues which include skills and opportunities to do so. The Theory of Planned Behaviour model has effectively predicted many different types of health behaviours, however some of its constructs do not apply well to specific behaviours. Nevertheless all of the predictors of intention can be effected by additional external variables such as gender and education.

A further development of this model is the ASE Model (De Vries et al, 1988) which incorporates both the Theory of Planned Behaviour and social learning theory (Bandura,1986). In this model the constructs of normative beliefs are replaced by social influences, and perceived control is represented by self-efficacy. Social influences are a result of social support and the relevant behaviours of important others. Brug et al (1995) in their study found that attitudes and self-efficacy were consistently associated with intention to perform a behaviour, whilst social influences were only significant in some behaviours. The authors investigated psychological factors associated with intention to increase fruit and vegetable intake.

This study investigates the predictive value of the ASE model in the context of interest in and intention to change dietary behaviour. The psychological factors which make up the ASE model will be used to look at differences in intention to change behaviour, taking account of past changes in behaviour and demographic characteristics.

Method

Data were collected at bowel cancer screening clinics in the same questionnaire described in the previous study Chapter 3.

Measures

Interest in more information

Participants were asked if they would like more information about adopting a healthy diet. There were four possible responses: definitely yes/yes maybe/not sure/definitely not.

Intention to eat more

Participants were asked whether they intended to increase their intake of fruit and vegetables within the next 6 months. Those who answered 'yes' were categorised as intenders and those who answered 'no' were classified as non-intenders. There were separate questions for fruit and for vegetables.

Beliefs about fruit and vegetables

Participants were asked about specific beliefs/attitudes to fruit and vegetables as described in Chapter 3. These are grouped into positive and negative aspects of fruit and vegetables; and included taste, price, convenience, preparation, storage and quality. Additionally, liking of fruit and vegetables was to be investigated, since many studies confirm that likes and dislike, especially the latter, are significant determinants of food choice (Gibson, Wardle and Watt, 1998). Participants were asked to rate how much they liked four different fruits and four different vegetables, chosen from the 1990 Nutritional Survey as among most frequently eaten fruit and vegetables (apples, orange, bananas, tinned fruit, peas, carrots, tomatoes and green leafy vegetables). Participants rated liking from 'strongly like' to 'strongly dislike' using a five point Likert scale.

Beliefs about behavioural change

Beliefs about behavioural change were assessed as perceived benefits and perceived barriers to increasing fruit and vegetable. The section on benefits and barriers was adapted from Trenkner, Rooney, Viswanath, Baxter, Elmer, Finnegan, Graves, Hertog, Mullis, Pirie, and Potter (1990) nutrition attitudes scale, which indexed, perceived benefits and barriers to eating behaviour change. They looked at health-related changes to diet including items about fat, fruit and vegetables and overall diet. For use in the present study, items which could be adapted specifically to fruit and vegetables were included. These can be broadly divided into health-related benefits and practical barriers of increasing fruit and vegetable intake. Health related benefits were used because of the context of the questionnaire (cancer screening clinics) and also because health behaviours were central constructs to other measures used throughout the questionnaire.

Table 1 Health benefits and practical barriers statements
Health benefits
Eating lots of fruit/vegetables decrease my chance of developing heart disease
Eating lots of fruit/vegetables will make me healthier
Eating lots of fruit/vegetables will reduce my chances of getting cancer in later life
Practical barriers
It is hard for me to plan ahead to eat more fruit/vegetables
Eating lot of fruit/vegetables means I won't enjoy my food as much
It is difficult to know how to fit more fruit/vegetables in my diet

Each statement was rated for agreement on a 4 point scale from 'strongly agree', 'agree', 'disagree' to 'strongly disagree'. The categories differ slightly from those used by Trenkner et al (1990). Piloting showed that participants did not like the categories of 'somewhat agree' or 'somewhat disagree' finding them ambiguous, so 'agree' and 'disagree' were used instead.

Self-efficacy

Subjects were asked a variety of questions on self-efficacy to see if they had confidence in their ability to change their own dietary behaviour. Self-efficacy is a crucial factor associated with obtaining both control of present behaviour but also behavioural skills need to change undesirable behaviours. Items were adapted from a measure of the Self-Efficacy for Eating Behaviour questionnaire (SEEB) by Sallis, Pinski, Grossman, Patterson and Nader (1988). The SEEB has 5 groups of questions for healthy eating: resisting relapse, reducing calories, reducing salt, reducing fat, and behavioural skills. Questions were adapted from the behavioural skills and an additional section on increasing both fruit and vegetable intake was added. Sallis et al (1998) included 28 questionnaires relevant to healthy diets. However the majority of the questions use American language and therefore inappropriate for a British audience. Also the classification categories were reduced to 5 categories were used. 'Sure I could do it' was changed to 'definitely can' because it was more in keeping with British dialect.

Some questions from this category have been adapted from a measure from the Institute of Food Research in Reading (Cox et al, 1996), which includes practical ways to increase intake. In this study they used a 7 point scale from extremely difficult to extremely easy.

Table 2 Self-efficacy statements
Choose fruit more often for dessert
Always keep some fruit in the house
Eat fruit for snacks instead of sweets or cakes
Have more than one serving of vegetables with your meal
Eat raw vegetables for snacks instead, of crackers or crisps
Have vegetables or a salad with both lunch and dinner

Social influences

It was important to investigate the role others played in intention to eat more fruit and vegetables. Therefore a variation of the traditional social norm measure of normative belief was used. During piloting it was evident that a measure asking about important other's opinion of fruit and vegetable intake was inappropriate. A measure which looked at perceived intake in comparison to important others was used. Participants had to rate their intake in comparison to friends and family using a 4 point scale as in other questions.

e.g *My friends and family eat more vegetables than I do*

Additionally a one item measure of social support was included as a second social influence measure. The social support measure was adapted from Marcoux, Trenkner and Rosenstocks' (1990) social support questionnaire used specifically with weight control. They come up with four specific areas: positive affective, appraisal, instrumental and interference. Only instrumental support was included in the present study, because it was the most appropriate item for a 1 item measure of support.

e.g If I were trying to eat more fruit my friends and family would eat more fruit with me.

Disease susceptibility

Health belief questions were used to ascertain people beliefs about their own health in relation to specific diseases. These have been adapted from the work of Weinstein (1982) looking at unrealistic optimism where they used a self-rated health questionnaire. Participants had to rate their chance of getting disease compared to somebody of their age and sex. A five part Likert scale from much lower to much higher was used for the answer. The disease selected were cancer and heart disease which are related to intake of fruit and vegetables as well as being the largest causes of mortality.

Past changes in behaviour

Participants were asked about past increases in both fruit and vegetable intake. Have you ever changed your eating habits in the past to increase the amount of fruit/vegetables in your diet? Past behaviour is included to look at the impact of habit rather than as a predictive factor for change.

Demographic characteristic

Demographic characteristics were measured as in Chapter 3 (gender, economic deprivation and education).

Results

Sample

The sample was as in Chapter 7, 1051 participants from cancer screening clinics in the UK with 586 women and 495 men.

Intention to eat more fruit and vegetables

Intention to eat more fruit and vegetables was taken from the first question in the stage of change measure. Therefore participants were classified as those who intended to make changes and those who had no intention to change their intake. The majority of participants did not intend to increase their fruit intake vegetable intake. Using Chi Square there were no demographic differences between intenders and non intenders for fruit or vegetables increases apart from there being more men who intended to increase their consumption of fruit (χ^2 =4.77, df[1], p<0.05). (See Table 3)

Table 3 Demographic differences in intention to increase fruit and vegetable intake

	Intention to increase fruit				Intention to increase vegetables			
	Intention		No intention		Intention		No intention	
	n	%	n	%	n	%	n	%
Total sample	261	25	75	776	213	20	828	80
Gender								
Men	106	22	373	78	93	19	387	81
Women	145	28	370	72	112	22	407	78
Qualifications								
Primary	9	20	37	80	5	11	42	89
Secondary	152	27	414	73	124	22	445	78
Trade	41	26	116	74	28	18	129	82
Diploma	22	23	74	77	21	21	77	79
Degree	20	18	92	82	22	20	89	80
Economic deprivation								
High	21	32	44	68	11	17	55	83
Medium	37	28	95	72	32	24	100	76
Low	192	24	599	76	160	20	635	80

Interest in more information

Participants were asked whether they were interested in receiving more information about adopting a healthy diet. More than half of participants indicated that they definitely would like more information, with only a minority responding that they definitely would not like more information about adopting a healthy diet. Chi Square analysis was used to look at demographic differences in those who wanted more information and those who did not. There were no differences by gender, economic deprivation level or highest qualification level. (See Table 4)

Table 4 Demographic differences in interest in more information

	Definitely more information		**Probably more information**		**Not sure**		**Definitely not**	
	n	%	n	%	n	%	n	%
Total sample	551	58	210	22	78	8	112	12
Gender								
Men	272	59	86	19	46	10	54	12
Women	279	57	124	25	32	6	58	12
Qualifications								
Primary	23	49	10	21	8	17	6	13
Secondary	323	60	125	23	38	7	55	10
Trade	85	57	29	19	18	12	18	12
Diploma	59	64	22	24	3	3	8	9
Degree	53	50	21	20	8	8	23	22
Economic deprivation								
High	40	61	12	18	6	9	8	12
Medium	70	57	28	23	13	10	13	10
Low	435	60	170	22	59	8	90	12

Factor analysis has been conducted on the following variables to look at the factoral structure of the different psychological concepts and also to assess for validity of composite scores.

Beliefs about fruit and vegetables

Attitudes used in study 3 were examined. Using a varimax rotation, two factors were identified. These related to positive factors (taste, convenience, quality and preparation) associated with intake and negative factors (price and storage). Cronbach's α are shown in Table 5. Intrascale reliability was satisfactory for positive factors for fruit and moderate for vegetables. However, the negative factors scale for fruit and for vegetables had low levels of reliability.

Table 5 Cronbach's α scores for positive and negative factors associated with current intake

	Fruit	**Vegetables**
Positive factor	0.74	0.60
Negative factor	0.48	0.41

Scores for positive and negative factors were created by combining individual scores and then scaling these down to between 1 and 3 (1 = low, 2 = medium, 3 = high) The majority of participants rated positive factors for fruit highly. Although fewer rated positive factors highly for vegetables, there was still a large proportion (64%). A third of participants rated negative factors for fruit highly, whilst half rated negative factors for vegetables high. See Table 6.

Table 6 Positive and negative factors for fruit and vegetables

	Fruit				**Vegetables**			
	Positive		**Negative**		**Positive**		**Negative**	
	n	%	n	%	n	%	n	%
High	863	90	326	35	583	64	173	19
Medium	90	9	306	32	315	35	257	28
Low	3	1	309	33	7	1	479	53

Women rated benefits of fruit (t [df=935] = -2.73, $p<0.01$) and benefits of vegetables (t [df=886] = -3.79, $p<0.01$) higher than men. There were no gender differences in rating of barriers for fruit (t [df=922] = -0.79, p ns) or vegetables (t [df=889] = -1.53, p ns).

Liking of fruit and vegetables

The majority of people claimed to like both fruit and vegetables very much. However fewer than half of participants liked tinned fruit very much. Using principal component analysis, 2 factors were extracted by varimax rotation, liking for fruit with factors with loadings between 0.46-0.75 (Cronbach Alpha=0.43) and liking for vegetables with factor loadings between 0.57-0.77 (Cronbach Alpha=0.63). Liking for fruit was significantly correlated with liking for vegetables (r_s=0.27, p<0.001).

Table 7 Liking for fruit and vegetables

	Dislike very much		Dislike a bit		Neither like nor dislike		Like a bit		Like very much	
Liking	n	%	n	%	n	%	n	%	n	%
Apples	7	1	28	3	50	5	214	21	704	70
Oranges	17	2	31	3	51	5	269	27	630	63
Bananas	22	2	14	1	31	3	153	15	780	78
Tinned fruit	26	3	31	3	129	13	335	34	472	47
Carrots	14	1	16	2	43	4	208	21	725	72
Peas	6	1	17	2	49	5	230	23	700	70
Tomato	18	2	16	2	28	3	169	17	770	77
Green leafy vegetables	11	1	21	2	38	4	172	17	761	76

Beliefs about behavioural change

Respondents were asked to rate how much they agreed with statements about the perceived health benefits and the practical barriers to increasing intake of both fruit and vegetables. The frequency of benefits and barriers are shown in Table 8 for fruit and Table 9 for vegetables.

Table 8 Health benefits and practical barriers to increasing fruit intake

	Strongly disagree		Disagree		Agree		Strongly agree	
	n	%	n	%	n	%	n	%
Health benefits (+)								
Decreases risk of cancer	6	1	148	15	668	68	161	16
Decreases risk of heart disease	12	1	134	13	695	70	160	16
Makes one healthier	2	0	30	3	719	70	273	27
Practical barriers (-)								
Hard to plan ahead	93	9	565	57	319	32	20	2
Reduces food enjoyment	224	22	683	68	74	7	30	3
Difficult to fit in diet	67	7	517	51	396	39	30	3

Table 9 Health benefits and practical barriers to increasing vegetable intake								
	Strongly disagree		Disagree		Agree		Strongly agree	
	n	%	n	%	n	%	n	%
Health benefits (+)								
Decreases risk of cancer	14	1	135	14	655	67	180	17
Decreases risk of heart disease	21	2	117	12	703	69	171	17
Makes one healthier	4	1	23	2	719	69	290	28
Practical barriers (-)								
Hard to plan ahead	82	8	556	56	343	34	23	2
Reduces food enjoyment	254	25	648	63	88	9	30	3
Difficult to fit in diet	63	6	436	43	481	48	34	3

The results indicate that a third of participants would find it hard to plan ahead to eat more fruit and vegetables, and almost half would find it difficult to fit more fruit and vegetables into their diet.

Even though the majority of participants agreed that eating lots of fruit and vegetables make you healthier, approximately 15% did not agree that increasing intake of fruit and vegetables would reduce the risk of cancer or heart disease.

Using principal component analysis 2 factors were extracted using varimax rotation for both fruit and vegetables. The factors extracted can be identified as health benefits and practical barriers with factor loading ranging from 0.54-0.87 for fruit and 0.58-0.81 for vegetables. Cronbach's α are shown in Table 10. There were good intrascale reliability for health benefits of fruit and practical barriers with moderate reliability for health benefits of vegetables and practical barriers of fruit.

Table 10 Cronbach's α scores for Benefits and Barriers		
	Fruit	**Vegetables**
Health benefits	0.78	0.56
Practical barriers	0.65	0.71

An overall health benefits and practical barrier scores were created by adding the scores for those factors for fruit and vegetables, which ranged from 3 –12 with 3 being low in perceived health benefits score but high in perceived practical barrier scores.
There were no gender differences in practical barriers to fruit and vegetables or health benefits of fruit but women rated health benefits of vegetables higher than men (t [df=940] = 4.56, p<0.01).

Self-efficacy for increasing fruit and vegetable intake

Self-efficacy was measured by asking people how confident they were that they could do specific behavioural strategies. These are presented in Table 11.

The strategies of always keeping fruit in the house was the easiest task with the majority of participants indicating that they would be able to do it whilst eating raw vegetables for snacks instead of crackers or crisps was the most difficult with less than a third of participants definitely able to do it.

Table 11 Self-efficacy for dietary behaviours

	Definitely can not		Probably can not		Don't know		Probably can		Definitely can	
Fruit	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Choosing fruit more often for dessert	17	2	80	8	50	5	515	50	362	35
Always keeping fruit in the house	7	1	18	2	6	1	155	14	836	82
Eating fruit for snacks instead of sweets or cakes	24	2	39	4	34	3	412	40	515	50
Vegetables										
Having more than 1 serving of vegetables with meals	24	2	68	7	37	4	376	37	522	51
Eating raw vegetables for snacks	69	7	148	15	102	10	407	40	290	28
Having vegetables or salad with both meals	33	3	112	11	51	5	430	42	395	39

Using principal component analysis for self-efficacy for fruit and vegetables change extracted one factor for each. Factor loading ranged from 0.72-0.81 for fruit (Cronbach's α= 0.64, moderate) and 0.73-0.86 for vegetables (Cronbach's α= 0.67, moderate). The majority of participants had high levels of self-efficacy for fruit (87%) with less having high levels of self-efficacy for vegetables (66%). There was a high correlation between self-efficacy ratings for fruit and vegetables (r_s0.68, $p<0.001$).

There were gender differences in levels of self-efficacy with women having higher levels of self-efficacy for increasing fruit (t [df=970] = -3.36, $p<0.01$) and vegetable (t [df=970] = -7.65, $p<0.001$) intake than men. (See Table 12)

Table 12 Self-efficacy differences by gender

(min 3-max 15)	**Men**		**Women**	
	Mean scores	**s.d.**	**Mean scores**	**s.d.**
Self-efficacy for fruit	12.98	1.89	13.38	1.86
Self-efficacy for vegetables	11.35	2.60	12.51	2.39

Social influences

Social support for behavioural change and social comparison were investigated. It was found that 20% of respondents thought their friends and family ate more fruit and a quarter thought that their friends and family ate more vegetables than they did. Over half of the sample felt that if they were trying to eat more fruit and vegetables their family and friends would not eat more with them. The relatively low level of estimated social support may be due to the age of the sample which may indicate that they do not live or have regular social contact with friends and family.

Table 13 Social support and social comparison for fruit and vegetables								
	Strongly disagree		Disagree		Agree		Strongly agree	
Vegetables	n	%	n	%	n	%	n	%
Social support	58	6	477	48	415	42	47	5
Social comparison	132	13	677	67	170	17	36	3
Fruit								
Social support	54	5	492	50	398	40	48	5
Social comparison	108	11	644	64	221	22	37	4

Perceived susceptibility to disease

Respondents were also asked about their perceived susceptibility to cancer and heart disease in comparison to somebody of the same age and sex. It was found that 6% of the sample indicated that they thought they had a higher chance of getting cancer and 14% thought they had a higher chance of getting heart disease. Disease susceptibility was significantly correlated for cancer and heart disease (rs 0.61, $p<0.0001$). Women had higher levels of perceived susceptibility to both cancer (t [df=982] = -3.11, $p<0.01$) and heart disease (t [df=979] = -3.05, $p<0.01$) than men.

Table 14 Susceptibility to cancer and heart disease										
	Much lower		Lower		The same		Higher		Much higher	
	n	%	n	%	n	%	n	%	n	%
Heart	71	7	240	24	539	55	108	11	26	3
Cancer	60	6	231	23	637	65	48	5	11	1

Past changes in behaviour

35% of participants had made past change to fruit intake whilst 24% had made past changes to their vegetable intake.

Univariate analysis of factors associated with interest in more information

Analysis of variance (ANOVA) was used to look at possible differences in psychological variables between the 4 interest groups.

Table 15 Differences in psychological variables by interest in more information	Definitely interested n = 551 (56%)	Probably interested n = 210 (22%)	Not sure n = 78 (8%)	Definitely not interested n = 112 (12%)	Anova (F, p)
Positive attitudes					
Fruit	3.27	3.22	3.12	3.26	F=3.62, p<0.05
Vegetables	3.06	3.02	2.89	2.99	F=4.11, p<0.01
Negative attitudes					
Fruit	2.50	2.46	2.58	2.48	F=0.87, ns
Vegetables	2.27	2.32	2.32	2.27	F=0.54, ns
Health benefits					
Fruit	9.49	9.12	8.72	8.77	F=13.63, p<0.01
Vegetables	9.49	9.17	8.87	8.93	F=8.96, p<0.01
Practical barriers					
Fruit	6.42	6.71	6.93	6.55	F=3.67, p<0.05
Vegetables	6.53	6.88	6.83	6.63	F=3.28, p<0.05
Self-efficacy					
Fruit	13.44	13.07	12.11	12.89	F= 12.48, p<0.01
Vegetables	12.29	12.01	10.45	11.27	F=14.65, p<0.01
Social support					
Fruit	2.52	2.42	2.24	2.38	F=4.58, p<0.01
Vegetables	2.52	2.44	2.24	2.35	F=4.80, p<0.01
Social comparison					
Fruit	2.15	2.18	2.29	2.31	F=2.42, p=0.06)
Vegetables	2.12	2.08	2.16	2.08	F=0.42, ns

Beliefs about fruit and vegetables

Participants who were definitely interested in dietary information scored highest on positive attitudes for both fruit and vegetables. The more interested individuals were in receiving more information the greater their rating of the positive factors. However individuals who definitely were not interested in more information scored somewhere between the other groups. There were significant differences between the groups for both fruit and vegetables. However there were no differences in groups for negative factors associated with fruit and vegetables.

Health benefits and practical barriers.

Differences in health benefits showed a similar pattern to positive factors. Increased interest in more information was related to higher ratings of health benefits for fruit and vegetables. Participants who definitely did not want more information rated health benefits the highest. There were also significant differences in practical ratings for fruit and vegetables dependent on group with those who were definitely interested rating practical barriers the least.

Self-efficacy

Again the strength of interest in more information was associated with higher levels for self-efficacy for fruit and vegetables.

Social factors

Participants who were most interested in information had the highest levels of social support. However there were no significant differences in social comparison levels. Therefore participants in the different interest groups rated their intake as similar in comparison to important others.

Intention to increase intake

Looking at the psychological factors associated with change (positive factors, negative factors, barriers and benefits and self-efficacy) there were no significant differences between intenders and non-intenders for fruit or vegetables. However intenders rated lower levels of social support for change and lower levels of social comparison for vegetables only. There were no differences for fruit.

Table 16 Differences in psychological factors by intention to change behaviour			
	Intention	**No intention**	**T test, p**
Positive attitudes			
Fruit	3.25	3.22	t=0.91, ns
Vegetables	3.03	3.02	t=0.34, ns
Negative attitudes			
Fruit	2.51	2.50	t=0.18, ns
Vegetables	2.29	2.27	t=0.52, ns
Health benefits			
Fruit	9.27	9.16	t=1.11, ns
Vegetables	9.28	9.37	t=-0.81, ns
Practical barriers			
Fruit	6.56	6.63	t=-0.73, ns
Vegetables	6.69	6.59	t=0.965, ns
Self-efficacy			
Fruit	13.22	13.07	t= 0.97, ns
Vegetables	11.97	12.04	t=-0.34, ns
Social support			
Fruit	2.46	2.41	t=1.00, ns
Vegetables	2.43	2.55	t=-2.16,p<0.05
Social comparison			
Fruit	2.18	2.18	t=0.15, ns
Vegetables	2.08	2.21	t=-2.69, p<0.01

Association between interest and intention

A Chi Square shows that there were no significant differences in intention to change diet based by interest in more information. Approximately 75% in each of the interest groups has no intention to change their intake of either fruit or vegetables, regardless of interest level. Using a Spearmans correlation it was found that there was not a significant correlation between interest in more information and intention to increase intake of fruit (r_s –0.005, p ns) or vegetables (r_s –0.02, p ns), when interest was split into binary categories.

Multivariate analysis

Predicting interest in more information

A logistic regression was used to look at predictors of interest in receiving more information. Interest in more information was combined into a binary variable with 'definitely interested' and 'probably interested' as 'interested' and 'not sure' and 'not interested' as 'not interested'. Self-efficacy, health benefits, practical barriers and social support for fruit and vegetables were all entered into the equation. Self-efficacy for vegetables, health benefits of fruit and practical barriers of vegetables were the only significant predictors of interest. Those who were more interested in receiving information had higher levels of self-efficacy for vegetables, higher perceived benefits of increasing fruit intake, and lower perceived barriers to increasing vegetables (see Table 17).

Table 17 Logistic regression for interest in more information

	R	**Sig**	**Odd ratio (*CI*)**
Self-efficacy for fruit	0.00	ns	1.08 (*0.97, 1.21*)
Self-efficacy for vegetables	0.13	0.001	1.18 (*1.09. 1.29*)
Fruit health benefits	0.10	0.002	1.47 (*1.15, 1.89*)
Vegetable health benefits	0.00	ns	0.95 (*0.80, 1.14*)
Fruit practical barriers	0.00	ns	0.87 (*0.68, 1.12*)
Vegetable practical barriers	0.05	0.0412	1.22 (*1.01, 1.48*)
Social support for increasing fruit	0.00	ns	1.44 (*0.97, 2.13*)
Social support for increasing vegetables	0.04	0.07	0.94 (*0.63, 1.41*)

Predicting intention to change

A logistic regression was used to investigate predictors of intention to change behaviour. In stages, demographic characteristics (gender, economic deprivation and highest qualification), ASE constructs (beliefs, self-efficacy and social influences), and past behaviour change were added to the model. The only significant predictors of intention to change fruit intake were gender (p=0.06) and past increases in behaviour, whilst for vegetables only past increases in vegetable intake was significant. Women were 1.4 times more likely to intend to increase their fruit intake, whilst those people who had made changes in the past were 1.6 times more likely (See Table 18).

Participants who had made changes in the past to their vegetable intake were 4.7 times as likely to intend to eat more vegetables in the future (see Table 19).

Table 18 Logistic regression for predictors of intention to increase fruit intake			
Intention to eat more fruit	**R**	**Sig**	**Odds ratio adjusted** (Exp (B) ∓ In (1.96xSe (B))
Demographic characteristics			
Gender	0.04	0.66	1.38 (*0.98, 1.94*)
Qualification	0.00	ns	0.91 (*0.78, 1.07*)
Economic deprivation	-0.01	ns	0.81 (*0.60, 1.08*)
Psychological factors			
Self-efficacy	0.00	ns	0.98 (*0.89, 1.08)*
Liking	0.00	ns	1.05 (*0.79, 1.40*)
Health benefits	0.00	ns	1.03 (*0.90, 1.18*)
Practical barriers	0.00	ns	1.04 (*0.92, 1.18*)
Benefits	0.00	ns	0.96 (*0.59, 1.57*)
Barriers	0.00	ns	0.98 (*0.71, 1.37*)
Social comparison	0.00	ns	1.00 (*0.75, 1.33*)
Social support	-0.00	ns	0.83 (*0.64, 1.07*)
Past changes in intake	0.07	0.011	1.56 (*1.11, 2.19*)

Table 19 Logistic regression for predictors of intention to increase vegetable intake			
Intention to eat more vegetables	**R**	**Sig**	**Odds ratio adjusted** (Exp (B) ∓ In (1.96xSe (B))
Demographic characteristics			
Gender	0.00	ns	1.13 (*0.76, 1.69*)
Qualification	0.00	ns	0.98 (*0.82, 1.17*)
Economic deprivation	0.00	ns	1.14 (*0.77, 1.68*)
Psychological factors			
Self-efficacy	0.00	ns	1.02 (*0.93, 1.12*)
Liking	-0.03	ns	0.78 (*0.57, 1.06*)
Health benefits	0.00	ns	1.03 (*0.88, 1.20*)
Practical barriers	0.00	ns	0.94 (*0.81, 1.10*)
Benefits	0.00	ns	0.80 (*0.43. 1.49*)
Barriers	0.00	ns	1.04 (*0.69, 1.58*)
Social comparison	0.01	ns	1.26 (*0.91, 1.75*)
Social support	0.00	ns	1.17 (*0.86, 1.58*)
Past changes in intake	0.28	0.000	1.56 (*1.11, 2.19*)

Summary of results

The aim of this study was to look at the application of the ASE model to intention to increase intake of fruit and vegetables, and furthermore to look at whether participant's interest in receiving health information is related to intention. The results indicate that intention to change behaviour is not associated with interest in having more information about behaviour change. Associations were found between interest in more information and psychological factors such as perceived health benefits of change, self-efficacy, liking for fruit and vegetables and social support for behaviour change. Intention to change behaviour was only associated with social support and social comparison for vegetables. It was found that changes in past behaviour predicted intention to change fruit and vegetable intake. Gender was also associated with intention to change fruit intake. The ASE model therefore does not have good predictive power in this investigation. As a representation of behaviour change, interest in change can be predicted by psychological characteristics of beliefs and self-efficacy whereby intention is only predicted by social influence characteristics.

Although the predictive value of the ASE model was not large in explaining variance, there were indications that participants with more positive attitudes in place were more likely to want more information, even if this was unrelated to intention.

Discussion

This chapter looks at the psychological factors relevant to interest in more information about dietary behaviour and intention to increase intake, in order to gain an understanding of the factors associated with thinking about change. In this study the factors used have been broadly based on an adaptation of the earlier work by Azjen and Madden (1986) who looked at the effect of attitudes, normative beliefs and perceived behavioural control on intention to change behaviour using the Theory of Planned Behaviour. Brug et al (1996) who investigated fat intake, used an adapted revision of this model called the ASE model, which looked at the role of attitudes, social norms and self-efficacy as predictors of intention. They found in their study that these factors were all significant predictors of intake. For the purpose of this study on food choices, it was decided to use the more recent adapted model to test the predictability of these variability for intention to increase fruit intake, vegetable intake and also interest in more information. In this study it was important to find out whether intention to change behaviour was related to an active interest in gaining more information relevant to this change.

The majority of people (over 75%) in this sample of older adults did not intend to increase either fruit or vegetables. This is substantially higher than another study by Cox et al (1996) who found that approximately 40% of participants did not intend to increase intake of either fruit or vegetables. However in their sample there was a response rate of 37% compared to 85% in this sample which may be indicative of a more interested sample responding. The lack of research investigating intention to increase fruit and vegetable intake mean that conclusions can not really be drawn about the representativeness of either sample. While intention has been shown to be important to dietary change in other studies (Shepherd, 1990) it may be a reflection of just desire and not actual dietary change (Cox et al, 1996). There were few demographic differences between those participants who intended to increase intake and those who did not. Fewer men than women intended to increase their vegetable intake than women do. There were no obvious reasons from the analysis to indicate why this may have occurred. However it is possible that although men may be interested in more information, they may not have made the decision to change their behaviour and thus are not intending to change it. There were no differences in demographic characteristics for interest in more information, which suggest that the sample who volunteered to take part in the intervention study were fairly representative of the total sample. The increased motivation for health of this sample may mean that the types of men, those with low socio-economic level or low education may differ from the normal population. It may be more challenging to get these groups to participate in programs if they do not have a vested interest in their health.

Descriptive analysis of psychological factors showed that the majority of people believed in the health benefits of fruit and vegetables for reducing the risk of cancer and heart disease, and making one healthier. However some felt that it would be difficult to plan ahead to eat more fruit and vegetables and also difficult to fit more fruit and vegetables into the diet. Thus strategies for increasing intake should address these perceived barriers. It was found that the majority of the sample believed they ate more fruit and vegetables than their family and friends even though overall levels in Chapter 7 suggest low levels in this sample. This misconception of intake may be because of other factors such as knowledge. When participants were asked about support for increasing intake there low rated levels of perceived social support across the sample, which may be a result of the age group of participants. As the participants are older, they may be more inclined to live alone and possibly do not have a wide social support network.

The data were analysed to look at the association between interest in more information and the psychological factors. The significant factors associated with greater interest were higher positive factors, higher perceived health benefits, lower perceived practical barriers, higher self-efficacy and higher social support for change. Surprisingly there were no differences in any of the psychological factors associated with intention to increase fruit intake and only lower social support was related to intention to change vegetable intake.

Thus it is appears that different factors are associated with intention to change diet than interest in healthy diets. The ASE model was not found to predict intention to eat either fruit or vegetables. The only components, which were found to predict intention to eat more fruit, were gender and past increases. Therefore women and those who had made past changes in behaviour were more likely to have intentions to increase their fruit intake. For intention to eat more vegetables the only predictor was past change to vegetable intake. It is likely that past changes in behaviour are a habitual factor rather than a cause of change. It is somewhat surprising that none of the psychological variable measured were associated with intentions. However it was found that some of the factors in the ASE model did predict interest in more information. The results were not conclusive which may have been as result of finding predictors for general interest in a healthy diet as opposed to interest specifically for fruit or vegetables. For example, self-efficacy for fruit, perceived health benefits for fruit, perceived practical barriers for vegetables and social support of increasing vegetable were all significant factors in explaining the variance in interest. It was also surprising to find that interest in information about a healthy diet was not associated with intention.

Although participants who had higher levels of self-efficacy and more positive attitudes to increasing intake were more likely to be interested in more information this does not show causation. However it is likely that this raised confidence in dietary change means people are more likely to think about change, even if they do not intend to make changes to their behaviour.

The possible reasons why the results do not support the hypothesis are likely to be due to two issues, reliability of the questions and the type of sample. Unfortunately in this sample there was little variability in either intention or interest so predicting these factors was going to be difficult to achieve statistical significance. The reasons why there was no variability in the two outcome measures is likely to be due to the homogeneity of the sample. The intention questions were taken from the stage of change model, which will be discussed later on, whereby they are standardised questions of intention to change behaviours. However the composite measures of attitudes, benefits and barriers and self-efficacy did not have particularly high alpha reliability scores. Thus the composite scores were not very reliable in measuring the concepts for investigation.

The two issues of variability and reliability could also be a result of the nature of the sample. The low intention could be because people did not intend to change intake because 'at our age it is a bit late' as several said in piloting. However in this sample ¾ were interested in finding out more information about adopting a healthy diet. Thus there seems to be different stages to changing behaviour. Obtaining more information may result in more intentions but intentions to change behaviour alone are unlikely to change without appropriate reasons. The psychological factors used did not seem reliable for predicting intention in this sample, although they have been used previously to good use. Further analysis in the subsequent study sample will given us an indication whether this is possibly a result of a cohort effect.

Chapter 5 The effectiveness of a tailored intervention in changing knowledge, attitudes and behaviour

Introduction

The aim of this study was to examine the efficacy of a brief, tailored, mailed intervention in changing knowledge about, attitudes to and intake of fruit and vegetables over a 6 week period. This continues on from the work described in Chapter 3 which looked at predictors of fruit and vegetable intake in a cross-sectional survey and found evidence that better knowledge and more positive attitudes were associated with higher intake. The present intervention was designed to modify knowledge and attitudes and thereby increase intake. Participants received an intervention which was tailored to their individual characteristics as measured at baseline. Tailored interventions have been shown to be successful in changing a variety of health behaviours, including attendance for mammography, smoking and dietary behaviour. They have been shown to be effective in decreasing fat intake in a number of studies (Campbell *et al*, 1994, Brug *et al*, 1996), but have had limited success in changing fruit and vegetables intake. However in most of the studies, all three aspects of diet were tackled in the same intervention, which may have reduced the salience of the fruit and vegetable element of the intervention.

There are a variety of different methods used in the literature for tailoring of intervention. Some work focuses mainly on demographic characteristics such as gender and ethnicity (Kalichman *et al*, 1993). Elements from social cognition models such as the Health Belief and the Stage of Change model have also been used. The Stage of change model was developed by Prochaska and DiClemente (1986) in relation to intention to give up smoking and recovery from psychotherapy. Initially it was used as means of classifying individuals into discrete stages based on intention to change behaviour with implications for the best approach to treatment. However later on it was used as a method to tailor different interventions for smoking cessation (Prochaska & DiClemente, 1994), breast screening (Skinner et al, 1994) and dietary behaviour, taking account of factors associated with intention and past changes in behaviour.

The present study differs from other stage matched intervention studies because it also measures knowledge and attitudes, both as targets of the intervention and as potential mediators of behaviour change. The tailoring method combines the association between knowledge, attitudes and behaviour and the stages of changes model. Together the intervention incorporates the different processes involved in change as supported by the stages of change model, as well as relating to this to individual differences in attitudes and knowledge.

Method

The sampling frame for the intervention study comprised respondents to the baseline questionnaire (1054) who indicated an interest in receiving information about adopting a healthy diet, and given their name and address (n=744) (called study participants).

Participants were randomly allocated to the intervention or control (non-intervention) group, using a random number generation technique on Microsoft Excel. Where more than one person from a household was taking part in the intervention study, they were both allocated to the same experimental group to avoid cross contamination.

Sample size calculations

Power calculations were conducted to estimate the appropriate sample size to show a change in behaviour of 2 servings of fruit and vegetables a week (effect size change = 0.28). Using the Gpower programme the results indicated that for an effect size of 0.15 (standard deviation = 1.9), a sample of approximately 280 in each condition would provide 95% power with an alpha set at 0.05. At the time there were no similar intervention studies which found an effect on fruit and vegetable intake, so the power calculation was based on information from pilot data (e.g. standard deviation). 370 participants approximately were allocated to each group to cope with possible attrition in the study.

Procedure

Participants in the intervention group were all sent a personalised intervention in the form of a leaflet with a covering letter (see Appendix 1A and 1B). The letter asked them to read the leaflet carefully and informed them that they would be sent another questionnaire in a few weeks time. The controls simply received the follow-up questionnaire.

Developing the intervention materials

The intervention was both personalised and tailored, based on information collected at baseline about intake of fruit and vegetables, stages of change, attitudes and knowledge about recommended servings. (See Appendix 3 for different intervention statements).

Personalisation

The intervention was directed at the individual using their name throughout e.g. "why should you eat more fruit and vegetables Mr Blair" and on the front of the leaflet e.g. "a personal program designed for Mr Blair".

Tailoring

The intervention was tailored to an individual's characteristics recorded at baseline

Intake: feedback about present intake levels was given (e.g. "you presently eat 1 serving of fruit a day"), along with personalised advice on the amount of change necessary to increase intake to the recommended levels (e.g. "We recommend you increase the amount of fruit you eat by at least 1 serving a day and the amount of vegetables you eat by at least 2 servings a day"). If participants reported that they already consumed sufficient quantities, they were encouraged to keep their intake up to this level (e.g. "We recommend that you carry on eating at least as much fruit and vegetables as you are eating at the moment").

Knowledge: feedback was given about beliefs of recommended levels (e.g. "You said you thought health experts recommend 4 servings of fruit and vegetables a day") along with information on actual recommended levels (e.g. "In fact the new recommendation is that people should eat at least 5 servings of fruit and vegetables a day"). The recommended amount of at least 5 servings a day of fruit and vegetables was emphasised throughout the leaflet. Additionally there was information specific to nutrient content and health benefits of fruit and vegetables. There was comprehensive information about appropriate serving sizes with examples for many fruit and vegetables. It was also stressed that tinned, frozen and dried fruit and vegetables could be counted as part of the recommended daily amount.

Stage of change: feedback on intention to change behaviour was given (e.g. "You said you are not planning to increase the amount of fruit and vegetables you eat. It is important that you rethink this Mr Blair. We hope that this leaflet will give you some ideas about why fruit and vegetables are important, and also information on the processes needed to sustain or change behaviour (e.g. "It may help if you spend a little time thinking about the amount of fruit and vegetables you are eating at the moment Mr Blair). You should consider the benefits you would get from eating more fruit and vegetables. Good luck!"). The theoretical background behind the intervention was based around the work done by Prochaska & DiClemente (1983) on smokers using processes of change. The intervention took account of the psychological processes associated with the individual's intention to change behaviour and past behaviour. For example, for participants who were classified as in the precontemplation stage, the focus was on benefits of eating more fruit and vegetables. Those participants in the decision making stage had information focused on practical ways of increasing intake whilst those in the maintenance stage were encouraged to seek social support and find other ways of resisting relapse. The process information came in the form of different statements. See Appendix F for examples from each stage. Where people were in a different stage of change for fruit and vegetables they were given individual stage information for both.

Attitudes: Reminders about reported negative attitudes (perceived barriers) (e.g. "you said you thought vegetables are expensive") were given with information and suggestions about how to overcome them (e.g. "Vegetables can work out cheaper than you think. They are a cheap way of filling up and adding variety to your meals. Look out for special and seasonal offers at your local shops and supermarkets."). This applied to the six attitudinal factors examined which were perceived expense, taste, ease of storage, convenience, ease of preparation and availability of good quality fruit and vegetables.

Interactive: Participants were given behavioural strategies to increase fruit and vegetables intake and asked to tick if they managed to do any within the following week. Interventions that have some interactive element have been shown to be more successful than information only ones (Patterson *et al*, 1997).

Contact

A contact name and address was supplied so that participants would have a way to deal with queries. This also provided the option of personal contact which has been shown to increase responses to interventions. Only two individuals phoned both to say how useful and informative the leaflet was.

Message feedback file for tailoring

This contained messages in response to all possible answers at baseline. There were 97 different messages with over 30 million possible combinations of the leaflet. Using Microsoft Excel and Microsoft Word a mail merge document was developed to create interventions based on answers to the baseline questionnaire.

The intervention was developed using information from a variety of sources. Information relating to nutritional knowledge was taken from leaflets provided by the Health Education Authority, Ministry for Agriculture, Food and Fisheries and the Cancer Research Fund. It was decided that the intervention would be a short leaflet about diet personalised and tailored to individual characteristics. The leaflet was two pages long and was designed in colour. There was a Flesh Readability score (Flesch, 1936) of approximately 75-80% for each of the statements used in the interventions which was equivalent to a reading age of 12 so not to discriminate against participants with lower literacy skills. (See Appendix 2 for example of intervention).

Piloting of the intervention was done with 12 patients attending for a sigmoidoscopy at bowel cancer screening clinic. The intervention leaflet was sent out by post and participants were contacted by phone a week later and asked questions about readability, comprehension, design, usefulness, interest and personalisation. All of the answers given were very positive so it was decided to use the current version of the intervention.

Follow-up questionnaire

Participants were mailed a personal letter written on University letterhead attached to a follow-up questionnaire 6 weeks after the interventions were sent out. This time period was selected because it gave enough time for people to make both behavioural and psychological changes which could not be detected in a shorter time period. The intervention and control follow-up questionnaires were both 2 pages long and had participant numbers (allocated at baseline from 1-1054) in the corner of each page to match up with baseline questionnaires. The intervention group had already been told that they would be contacted to fill in a questionnaire. They were also informed that they would be entered in a prize draw to win vouchers as a thank you for their co-operation in the study. The control group was told that more information was required to update the data so that they could be sent information shortly. They were also informed about the prize draw. A reminder letter was sent out 3 weeks after this with another copy of the questionnaire, if it had not been returned.

Measures

The follow-up questionnaire included the following items: (See Appendix 4) Note similarity to baseline questions.

Fruit and vegetable intake

Intake of fruit and vegetables was assessed, as at baseline with participant's self-reported ratings of their own intake for both fruit and vegetables. The single item measure asked specifically about recent intake to enable detection of behavioural changes over time. *e.g. recently how many servings of fruit have you been eating?* There were 8 categories to select from, ranging from 0-2 servings a week to 5+ servings a week. The self-reported intake question was altered from baseline because it was found to be difficult to pinpoint rate those participants who were definitely eating 5 servings a day.

Perception of adequacy of intake was assessed as at baseline by asking to select a box indicating whether they felt they ate too much, about right or not enough fruit and vegetables.

Stage of change

Stage of change was assessed using the following questions based on baseline assessments. There were different algorithms for stage categorisation depending on answers to the following questions.

a) Are you seriously thinking about increasing the amount of fruit/vegetables you eat sometime in the next 6 months? Yes→b/No→ d

b) If yes, are you planning to make this increase the next month? Yes (preparation)/No (contemplation)

c) Have you ever changed your eating habits in the past to increase the amount of fruit/vegetables in your diet? Yes→d/No (precontemplation)

If yes, how long ago did you make this change?_____ (<6 mths Action, >6 mths maintenance→see below)

d) Are you still eating more fruit/vegetables than you used to? Yes/No(relapsers)

This was included to assess whether participants had progressed to a more advanced stage of change. These varied from the baseline questions because it was necessary to detect recent perceived changes in intake or intention, but the same algorithms applied.

Nutritional knowledge

Nutritional knowledge was re-assessed, although at follow-up more questions were asked to gain a wider understanding of individual knowledge. Participants were asked about the link between eating too little fruit and vegetables and major health problems or diseases as before, and if yes were asked to list any disease or health problems. This was done to see if there were differences in known diseases between the 2 groups. Participants were also asked about the number of servings recommended by health experts, and asked to guess if they did not know. Nutrient information asked about prior knowledge of antioxidants; and also for participants to estimate the antioxidant, vitamin, fibre and calorie content of fruit and vegetables. The categories were changed on the nutrient content questions to allow participants to select a 'don't know' option if so wished. Although there were now additional questions asked about nutritional knowledge it was still possible to look at group differences on new items as well as time differences on old items.

Attitudes

Attitudinal factors were assessed as at baseline by asking participants their agreement with statements concerning convenience, taste, price, storage, ease of preparation and availability of fruit and vegetables using a four point Likert scale from strongly agree to strongly disagree.

Intervention appraisal

Participants in the intervention group were asked about their perception of any changes in intake due to reading the intervention. They were asked to rank in order the importance of the following features of the leaflet; advice on increasing intake, information about diet and health, information about serving sizes, being printed in colour, being personalised to the reader and being easy to read. Those in the control group were asked to rank in order of importance the features they would like to see in a leaflet about diet using the above features.

Alternative information

Participants were asked whether they had read or heard any other information about eating more fruit and vegetables, and if so the source of this information. The choices were newspapers, magazines, TV and radio, friends, family, shops, GP clinic, dental clinics, hospitals and dieticians. These were selected after pilot interviews about sources of health information. Several government reports and articles in the media had discussed the role of fruit and vegetables during the intervention period so it was important to see if any of these had a contributory effect on the outcome measures. Both groups had the opportunity to make comments at the end of the questionnaire.

Participants in the non-intervention group were mailed a leaflet about increasing fruit and vegetables after final data collection.

Results of follow-up data

Baseline differences in participants and non participants

The sample of participants included in the intervention study comprised 742 people (71% of baseline participants) who had requested additional information in the baseline questionnaire and given mailing address. Comparing participant (n=742) and non-participant (n= 309) groups revealed no significant differences in any of the demographic characteristics (see Table 1).

Table 1 Sample characteristics for intervention participants and non participants

	Non Participants		**Participants**	
	n	**%**	**n**	**%**
Gender				
Men	130	49	355	48
Women	136	51	387	52
Qualifications				
Primary	15	6	33	4
Secondary	141	54	433	59
Trade	42	16	116	16
Diploma	23	9	76	10
Degree	40	15	72	10
Economic deprivation				
High	19	7	48	7
Medium	34	13	99	13
Low	211	80	590	80
Clinic area				
Newport	101	33	200	27
Leicester	141	46	358	48
Glasgow	66	21	184	25

Baseline knowledge, attitudinal and behaviour scores are shown in Table 2. There were no difference in any of these variables.

Table 2 Mean baselines scores of behaviour, attitudes and knowledge intervention participants and non participants		
	Non participants	**Participants**
	n = 311	**n = 742**
Total daily fruit intake	1.41 (1.19)	1.52 (1.24)
Total daily vegetable intake	1.56 (1.17)	1.50 (1.15)
Positive attitudes to fruit (1-4)	2.96 (0.32)	3.00 (0.31)
Positive attitudes to vegetables (1-4)	2.88 (0.31)	2.93 (0.33)
Nutritional knowledge (1-6)	4.84 (0.83)	4.76 (0.75)

Table 3 demonstrates stage of change distributions. Again there were no differences in proportions of stage of change between participants and non-participants in the intervention study.

Table 3 Stage of change distributions for fruit and vegetables for intervention participants and non participants				
	Non participants		**Participants**	
Stage of change for fruit				
Precontemplation	177	60	392	53
Decision making	73	24	182	25
Maintenance	56	18	167	22
Stage of change for vegetables				
Precontemplation	219	72	486	66
Decision making	55	18	149	20
Maintenance	32	10	104	14

Baseline differences in intervention and control group

Participants were randomly allocated to intervention (n=372) or control group (n=370), so no demographic or psychological differences were expected. Analysis of variance comparing the intervention group and control group shows that there were no demographic differences (see Table 4).

Table 4 Sample characteristics for intervention group and control group				
	Intervention group		**Control group**	
	n	**%**	**n**	**%**
Gender				
Men	177	48	178	48
Women	195	52	192	52
Qualifications				
Primary	16	4	17	5
Secondary	221	60	212	57
Trade	48	13	68	19
Diploma	42	11	34	9
Degree	41	11	31	9
Economic deprivation				
High	24	7	24	7
Medium	42	11	57	15
Low	301	82	289	78
Clinic area				
Newport	105	28	95	26
Leicester	173	47	185	50
Glasgow	94	25	90	24

There were also no differences in intake of fruit or vegetables, nutritional knowledge, or attitudes to vegetables. By chance the control group were significantly more positive about attitudes to fruit than the intervention group ($t = -2.39$, df[678], $p<0.05$). Differences in attitude to fruit will be taken into account, when examining follow-up data (see Table 5).

Table 5 Mean baselines scores of behaviour, attitudes and knowledge for intervention group and control group		
	Intervention n = 372	**Control** n = 370
Total daily fruit intake	1.51 (1.20)	1.56 (1.28)
Total daily vegetable intake	1.56 (1.15)	1.45 (1.14)
Positive attitudes to fruit (1-4)	2.98 (0.30)	3.03 (0.32)
Positive attitudes to vegetables (1-4)	2.92 (0.32)	2.94 (0.35)
Nutritional knowledge (1-6)	4.72 (0.75)	4.81 (0.76)

There were no differences between the intervention and control group for stage of change (see Table 6).

Table 6 Stage of change distributions for fruit and vegetables for intervention and control group				
	Intervention		**Control**	
Stage of change for fruit				
Precontemplation	196	53	196	53
Decision making	90	24	92	25
Maintenance	86	23	81	22
Stage of change for vegetables				
Precontemplation	237	64	249	68
Decision making	82	22	67	18
Maintenance	51	14	53	14

Follow-up response rates

641 participants (86%) responded to the follow-up questionnaire with 88% response rate (325) in the intervention group and 85% (316) in the control group. Another 1% of questionnaires were returned (8 in total) because the recipient had either moved away or died.

Differences between responders and non-responders to the follow-up questionnaires were analysed using ANOVA and Chi Square. In the control group there were differences in gender (χ^2 = 4.28, df[1], p<0.05) and economic deprivation (χ^2 = 11.39, df[2], p<0.01), with significantly fewer men and fewer of those with higher deprivation levels, responding to the follow-up questionnaire.

Table 7 Baseline differences between responders and non responders in the control group

	Responders		Non responders	
	n	**%**	**n**	**%**
Gender				
Men	145	46	33	61
Women	171	54	21	38
Qualifications				
Primary	12	4	5	10
Secondary	185	59	27	53
Trade	58	19	10	20
Diploma	29	9	5	10
Degree	27	9	4	8
Economic deprivation				
High	19	6	5	9
Medium	41	13	16	30
Low	256	81	33	61
Clinic area				
Newport	76	24	19	35
Leicester	160	51	25	46
Glasgow	80	25	10	19

Non-responders had consumed significantly fewer servings of vegetables at baseline (Anova df[366], F= 3.03, p<0.01), but there were no significant differences in overall nutritional knowledge, attitudes to fruit and vegetables or intake of vegetables. (see Table 8)

Table 8 Mean baselines scores of behaviour, attitudes and knowledge for control group responders and non responders		
	Responders n = 316	**Non responders** n = 54
Total daily fruit intake	1.63 (1.30)	1.13 (1.10)
Total daily vegetable intake	1.49 (1.12)	1.25 (1.23)
Positive attitudes to fruit (1-4)	3.03 (0.31)	3.01 (0.36)
Positive attitudes to vegetables (1-4)	2.94 (0.33)	2.94 (0.45)
Nutritional knowledge (1-6)	4.83 (0.76)	4.66 (0.71)

There were however no differences between responders and non-responder for stage of change (see Table 9).

Table 9 Stage of change distributions for fruit and vegetables for control group and responders and non responders				
	Responders		**Non responders**	
Stage of change for fruit				
Precontemplation	171	54	25	46
Decision making	75	24	17	31
Maintenance	69	22	12	22
Stage of change for vegetables				
Precontemplation	212	67	37	69
Decision making	56	18	11	20
Maintenance	47	15	6	11

In the intervention group there were no differences in either demographic factors, attitudes, knowledge or intake between responders and non-responders (see Tables 10 and 11).

Table 10 Baseline differences between responders and non responders in the intervention group				
	Responders		Non responders	
	n	%	n	%
Gender				
Men	158	49	19	40
Women	167	51	28	60
Qualifications				
Primary	15	5	1	2
Secondary	192	60	29	63
Trade	43	13	5	11
Diploma	36	11	6	13
Degree	36	11	5	11
Economic deprivation				
High	18	6	6	13
Medium	42	13	0	0
Low	262	81	39	87
Clinic area				
Newport	90	28	15	32
Leicester	154	47	19	40
Glasgow	81	25	13	28

Table 11 Mean baselines scores of behaviour, attitudes and knowledge for intervention group responders and non responders		
	Responders	**Non responder**
	n = 325	**n = 47**
Total daily fruit intake	1.51 (1.21)	1.53 (1.13)
Total daily vegetable intake	1.59 (1.18)	1.32 (1.01)
Positive attitudes to fruit (1-4)	2.96 (0.29)	3.05 (0.31)
Positive attitudes to vegetables (1-4)	2.91 (0.31)	3.01 (0.32)
Nutritional knowledge (1-6)	4.72 (0.75)	4.73 (0.78)

However more responders were in the maintenance group for the stage of change for fruit (χ^2 = 8.58 df[2], p<0.01), although there were no differences for stage of change for vegetables (see Table 12).

Table 12 Stage of change distributions for fruit and vegetables for intervention group and responders and non responders				
	Responders		**Non responder**	
Stage of change for fruit				
Precontemplation	165	51	31	66
Decision making	77	24	13	28
Maintenance	83	25	3	6
Stage of change for vegetables				
Precontemplation	208	64	29	62
Decision making	71	22	11	23
Maintenance	44	14	7	15

Effects of the intervention

Nutritional knowledge at follow-up

Estimated recommended servings

Changes in nutritional knowledge were observed and showed positive change for the intervention group on several elements. Using a MANOVA there was an increase in the estimation of recommended daily servings of fruit and vegetables from 4.0 to 4.9 in the intervention group, with a significant group by time interaction (Manova [1,603], F= 28.18, p<0.001). There were no significant increases in estimated recommended servings for the control group. See Table 13.

Table 13 Changes in estimates of recommended number of daily servings of fruit and vegetables					
		Baseline		**Follow-up**	
	n	**Mean**	**s.d.**	**Mean**	**s.d.**
Intervention	311	4.0	1.6	4.9	1.6
Control	303	4.2	1.7	4.3	1.7

There were no significant differences in percentage of people who knew about the 5 a day message at baseline (χ^2 = 2.3, df[1], ns). The proportion of participants that knew about the 5 a day message was significantly higher at follow-up for the intervention group compared to the control group. (χ^2 = 14.84, df[1], p<0.001). Using a Wilcoxan paired T-test shows there were significant increases in both the intervention group n=306, Z=-7.2, P<0.001) and the control group (n=298, Z=-2.36, P<0.05) from pre to post intervention time, but the effect was considerably larger in the intervention group.

Table 14 Proportion of participants correctly estimating 5+ daily servings

	Baseline		**Follow-up**	
	n	%	N	%
Intervention	142	45	233	73
Control	156	51	182	59

Knowledge of diet and disease relationship

At baseline, there were no group differences, but at follow-up significantly more people in the intervention group knew about diseases relating to diet (χ^2 =5.91, df[1], p<0.05). A Wilcoxan paired T-Test shows there were significant increases in numbers for both intervention group (n=292, Z=-90.07, p<0.001) and the control group (n=292, Z=-7.2, P<0.001) between baseline and follow-up, but the effect was slightly larger in the intervention group.

Table 15 Percentage of respondents saying they were aware of diseases related to fruit and vegetable consumption

	Baseline		**Follow-up**	
	n	%	N	%
Intervention	85	27	214	70
Control	94	31	183	61

Examining the data for those people who said that they knew about diseases related to low fruit and vegetable consumption, there was a significant difference between the numbers of people aware of specific diseases in the control group and intervention group (χ^2 =25.27, df[4], p<0.001). 24% of the intervention group knew about the link between fruit and vegetable consumption and both cancer and heart disease compared to only 10% of the control group. Other diseased mentioned include scurvy and rickets. Numbers of participants who mentioned various diseases are shown in Table 16.

Table 16 Knowledge about diseases related to fruit and vegetable consumption

	Intervention group		Control group	
	n	%	n	%
Did not specify a disease	123	38	135	43
Cancer alone	76	23	78	25
Heart disease alone	18	6	26	8
Other problems (rickets, scurvy etc.)	29	9	45	14
Both cancer and heart disease	79	24	32	10

Nutrient content

At follow-up significantly more participants in the intervention group (63%) had heard of antioxidants compared to the control group (52%) ($\chi^2 = 6.96$, df[1], $p<0.01$). Also significantly more participants in the intervention group correctly estimated fibre content ($\chi^2 = 50.09$, df[1], $p<0.05$) and calorie content ($\chi^2 = 4.81$, df[1], $p<0.05$) for fruit, and correctly estimated vitamin content ($\chi^2 = 4.82$, df[1], $p<0.05$), calorie content ($\chi^2 = 9.23$, df[1], $p<0.01$) and antioxidant content ($\chi^2 = 50.02$, df[1], $p<0.05$) for vegetables. There were marginal differences in ratings for antioxidants for fruit ($\chi^2 = 3.13$, df[1], $p= 0.08$) and fibre for vegetables ($\chi^2 = 2.97$, df[1], $p= 0.09$).

Table 17 Correct nutrient content estimation of fruit and vegetables

	Intervention		Control	
	n	%	N	%
Fruit				
Vitamins	195	62	180	58
Fibre	191	60	158	51
Calories	215	68	181	59
Antioxidants	81	27	63	21
Vegetables				
Vitamins	199	63	165	54
Fibre	218	69	191	62
Calories	219	71	181	59
Antioxidants	80	27	57	19

Attitudes

There were significant differences in rating for availability of good quality fruit locally and ease of preparation of fruit between control and intervention group at baseline, with the control group being more positive on both factors. Using a MANOVA to counteract these, differential changes in attitudes to certain characteristics of fruit and vegetables were examined. It was found that there were significant effects for fruit in relation to perceived quality (F [1,619], =4.63, $p<0.05$), taste (F [1,612], =4.55, $p<0.001$), ease of preparation (F [1,616], =6.39, $p<0.001$), storage (F [1,592], =6.14, $p<0.001$) and convenience (F [1,614], =5.46, $p<0.001$) with the intervention group becoming more positive over time compared to the control group. There was no significant effect for perceived expense of fruit.

There was no effect for any attitudinal items for vegetables (see Table 18).

Table 18 Mean attitude scores at baseline and follow-up (Scale 1-4)

Attitudes		**Fruit**		**Vegetables**	
		Baseline	**Follow-up**	**Baseline**	**Follow-up**
Quality	**Intervention**	3.00	3.06 *a**	3.04	3.06
	Control	3.13	3.07	3.11	3.10
Taste	**Intervention**	3.32	3.43 *a***,*b**	3.11	3.09
	Control	3.38	3.39	3.14	3.05
Preparation	**Intervention**	3.21	3.33 *a***,*b**	3.21	3.22
	Control	3.28	3.28	3.24	3.23
Storage	**Intervention**	2.56	2.43 *a***,*b**	2.43	2.36
	Control	2.48	2.50	2.42	2.41
Price	**Intervention**	2.45	2.43	2.15	2.15
	Control	2.47	2.48	2.17	2.16
Convenience	**Intervention**	3.28	3.45 *a***,*b**	2.70	2.76
	Control	3.35	3.38	2.73	2.79

a significant difference over time for intervention group *b* significant interaction between group over time

* $p<0.05$, ** $p<0.01$

Stage of change

Differences between groups

At baseline there were no significant differences in distribution of stage of change between the groups for either fruit (χ^2 = 1.27, df[2], ns) or vegetables (χ^2 = 1.81, df[2], ns) . However at follow-up there was a significant difference in the spread for stage of change for fruit (χ^2 = 20.5, df[2], p<0.001). More people in the intervention group were in the latter stage of decision making and maintenance. Results were similar for vegetable 'stages' (χ^2 = 13.7, df[2], p<0.001).

Figure 1 Stages of change for fruit

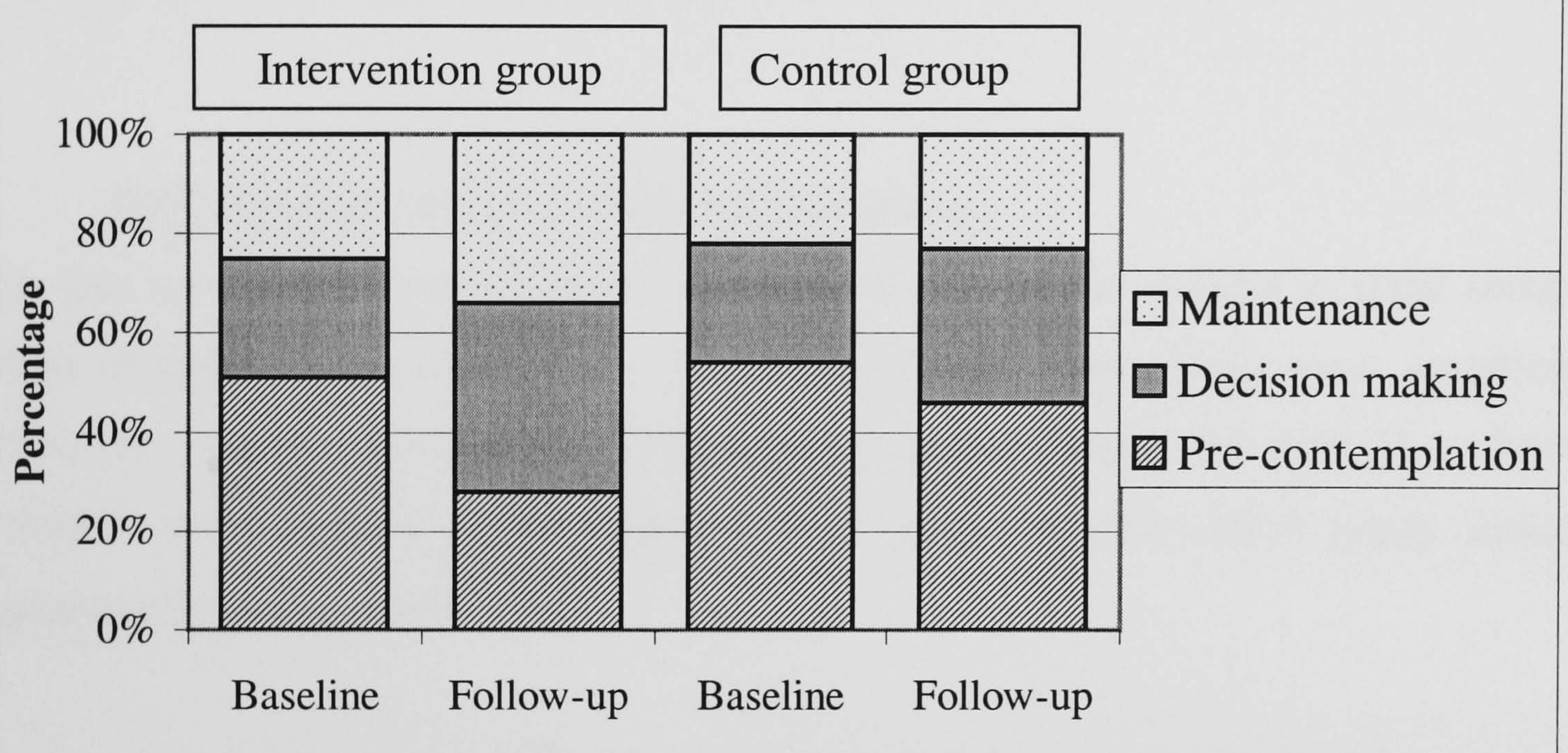
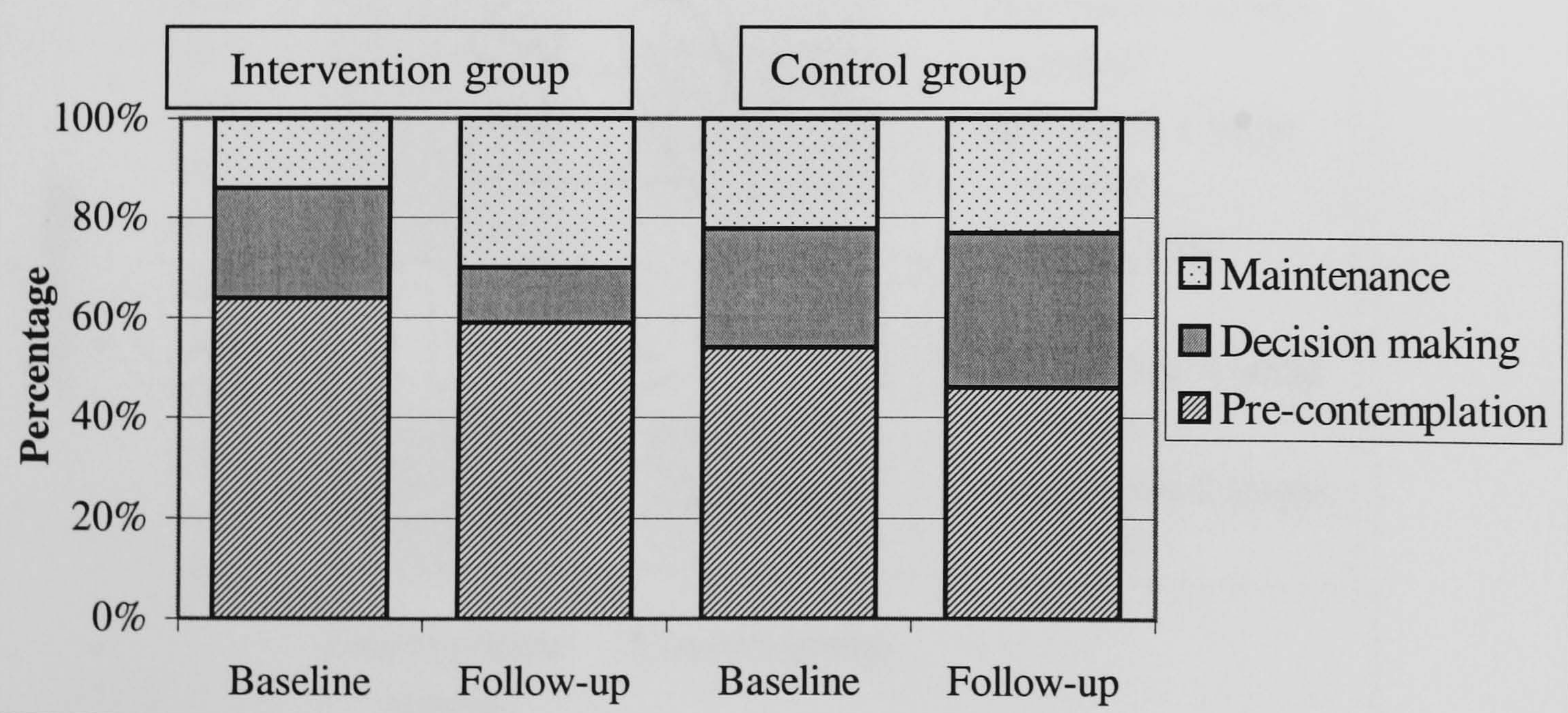


Figure 2 Stages of change for vegetables



Differences within groups

A Wilcoxon-Matched-Pairs Test was used to test for differences over time within groups. There were significant differences over time for the intervention group for both stage of change for fruit ($Z = -3.63$, $P<0.001$) and vegetables ($Z= -2.65$, $p<0.01$). In the intervention group, the number of participants increased by 14% for the decision making group (intention to increase behaviour) and 9% for maintenance group (having made behaviour change) for fruit. Whilst the intervention group also increased the number of participants in the maintenance group by 16%. There were no significant differences between baseline and follow-up for stage of change for either fruit ($Z= -0.86$, ns) or vegetables ($Z= -0.18$, ns) in the control group.

Differences in change of stage between groups

The data were also examined between groups to look at the changes in stage using a Mann Whitney Independent Pairs Test-Matched-Pairs Test. There were significant differences between groups for both changes in stage of change for fruit ($Z = -20.09$, $P<0.001$) and vegetables ($Z= -20.06$, $p<0.01$) with the intervention group making significantly more changes.

Figure 3 Changes in stages of change for fruit

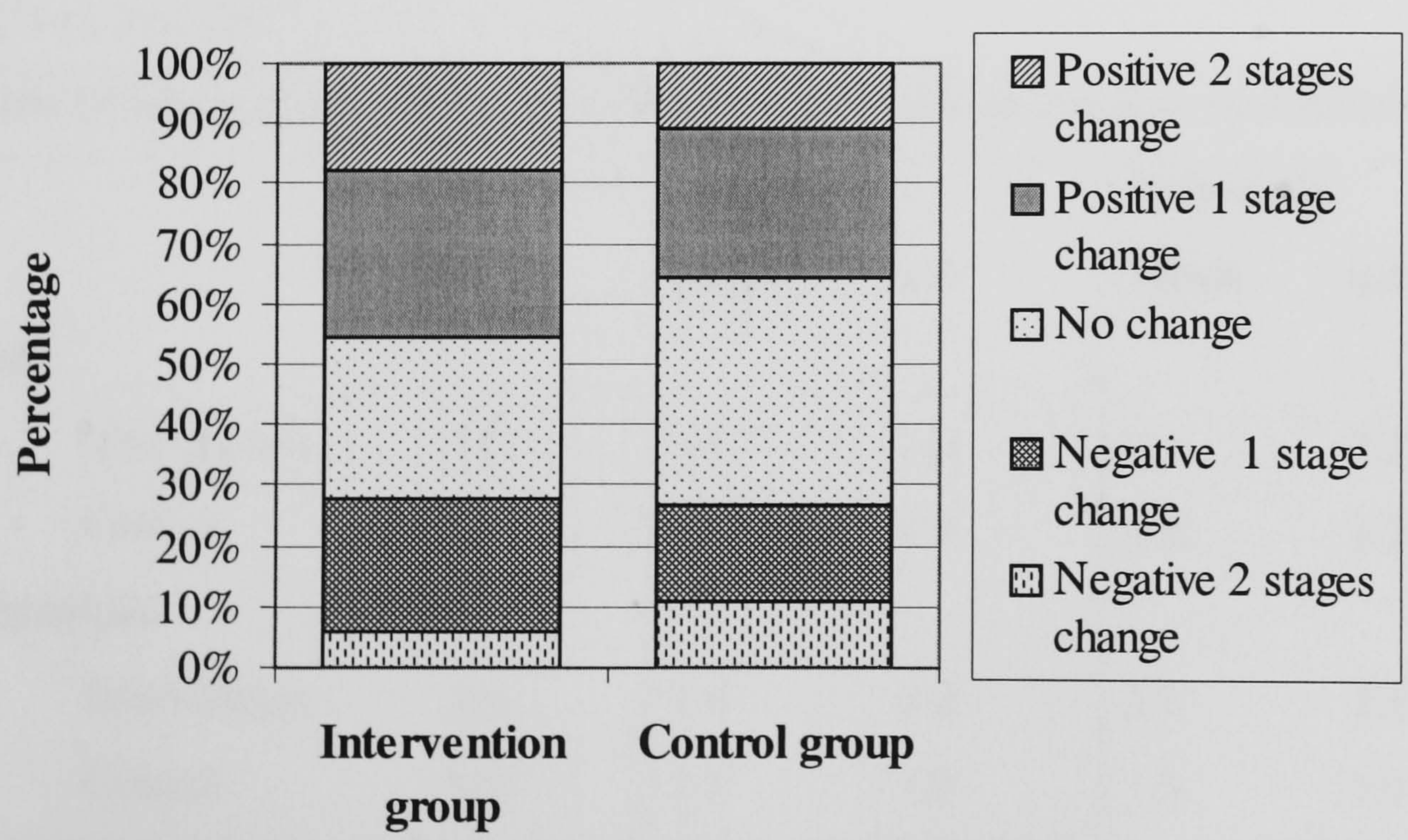
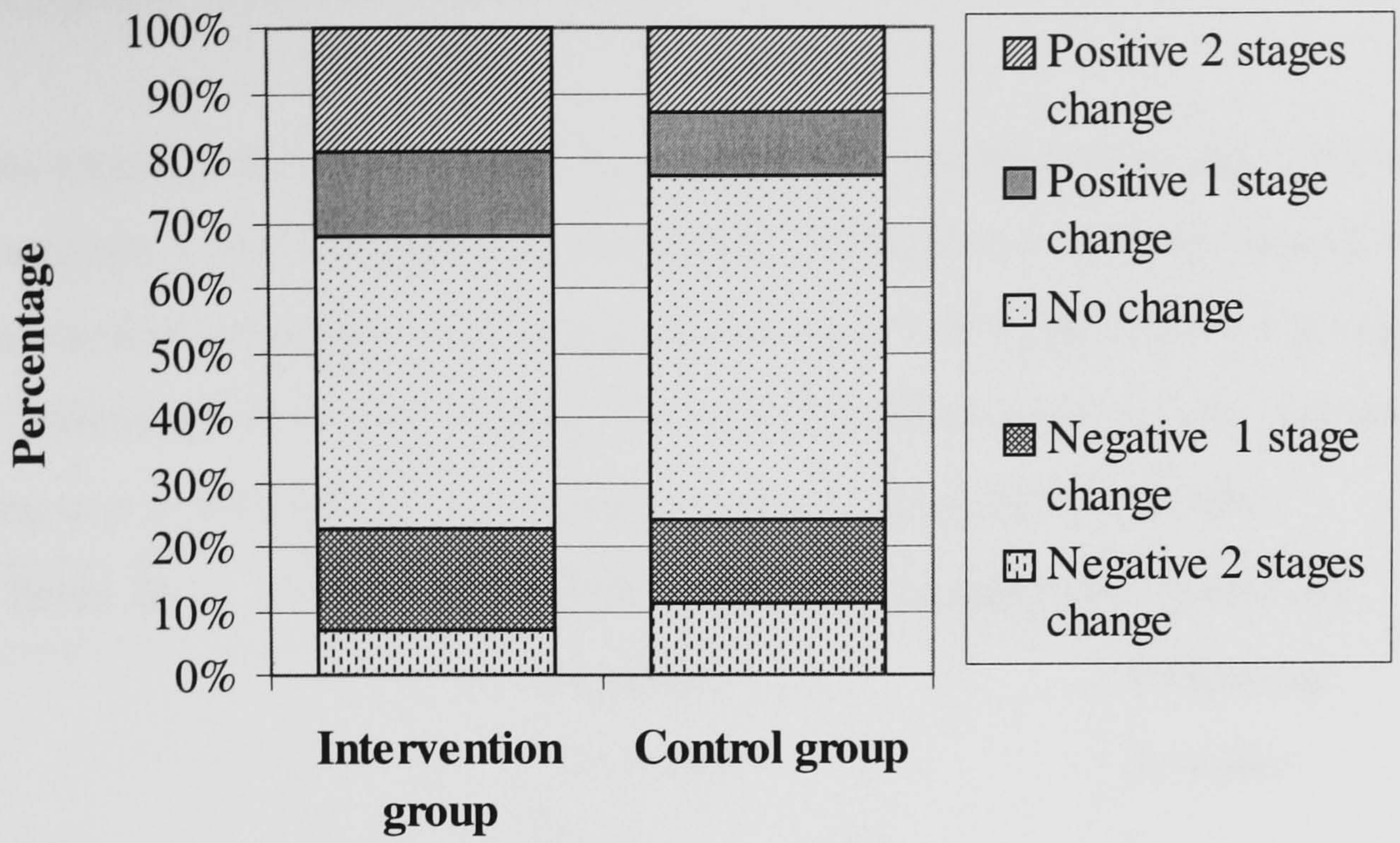


Figure 4 Changes in stage of change for vegetables



Dietary data

Intake levels for fruit and vegetables were approximately 1.5 servings for each group at baseline. At follow-up it was found that the intervention group had significantly increased their intake of fruit to 2.2 servings a day ($t=9.77$, df[322], $p<0.001$) and their intake of vegetables to 2.3 servings a day ($t=8.11$, df[320], $p<0.001$). There were also small, but significant increases in the control group, with fruit intake up to 1.8 servings a day ($t=2.15$, df[314], $p< 0.05$) and vegetable intake up to 1.6 servings a day ($t=2.17$, df[314], $p<0.05$).

Table 19 Mean daily intake of fruit and vegetables at baseline and follow-up

		Baseline		**Follow-up**	
	n	**Mean**	**s.d.**	**Mean**	**s.d.**
Fruit					
Intervention	323	1.5	1.2	2.2	1.2
Control	315	1.6	1.3	1.8	1.3
Vegetables					
Intervention	321	1.6	1.2	2.1	1.1
Control	315	1.5	1.2	1.6	1.1

Using a repeated measures analysis of variance (MANOVA) there was an interaction between group and time for both intake of fruit ($F[1,636]= 27.16$, $p<0.001$) and vegetables (F[1,634]= 19.77, p<0.001), with the increase in fruit and vegetable intake being greater in the intervention group.

Data were also analysed in terms of the numbers of participants who were eating at least 5 servings a day at follow-up by group. At baseline 24% of control and 28% of intervention participants were consuming at least 5 servings of fruit and vegetable a day. At follow-up, 45% had reached the recommended level in the intervention group, compared to only 28% in the control group (χ^2 =20.4, df[1], p<0.001).

Table 20 5+ servings a day by group at baseline and follow-up

	Baseline 5+ a day		**Follow-up 5+ a day**	
	n	**%**	**n**	**%**
Intervention	77	24	146	45
Control	91	29	88	28

Intention to treat analysis

An 'intention to treat' analysis was conducted to look at a possible biased effect of only including participants who returned follow-up questionnaires (88%). Therefore analysis was conducted on the effects of the intervention for all participants taking part in the study. All non-responders were assigned the average increase in intake levels at follow-up for the control group, therefore they were given follow-up intake level for fruit of (baseline fruit intake + 0.17) and for vegetables of (baseline vegetable intake + 0.13). Using a Manova there was still a significant interaction between groups over time for both fruit intake (F[1,735]= 27.84, p<0.001) and vegetable intake (F[1,634]= 19.77, p<0.001). Therefore we can conclude that the intervention does have an impact of behaviour even when we take account of possible bias from non responders.

Perception of intake

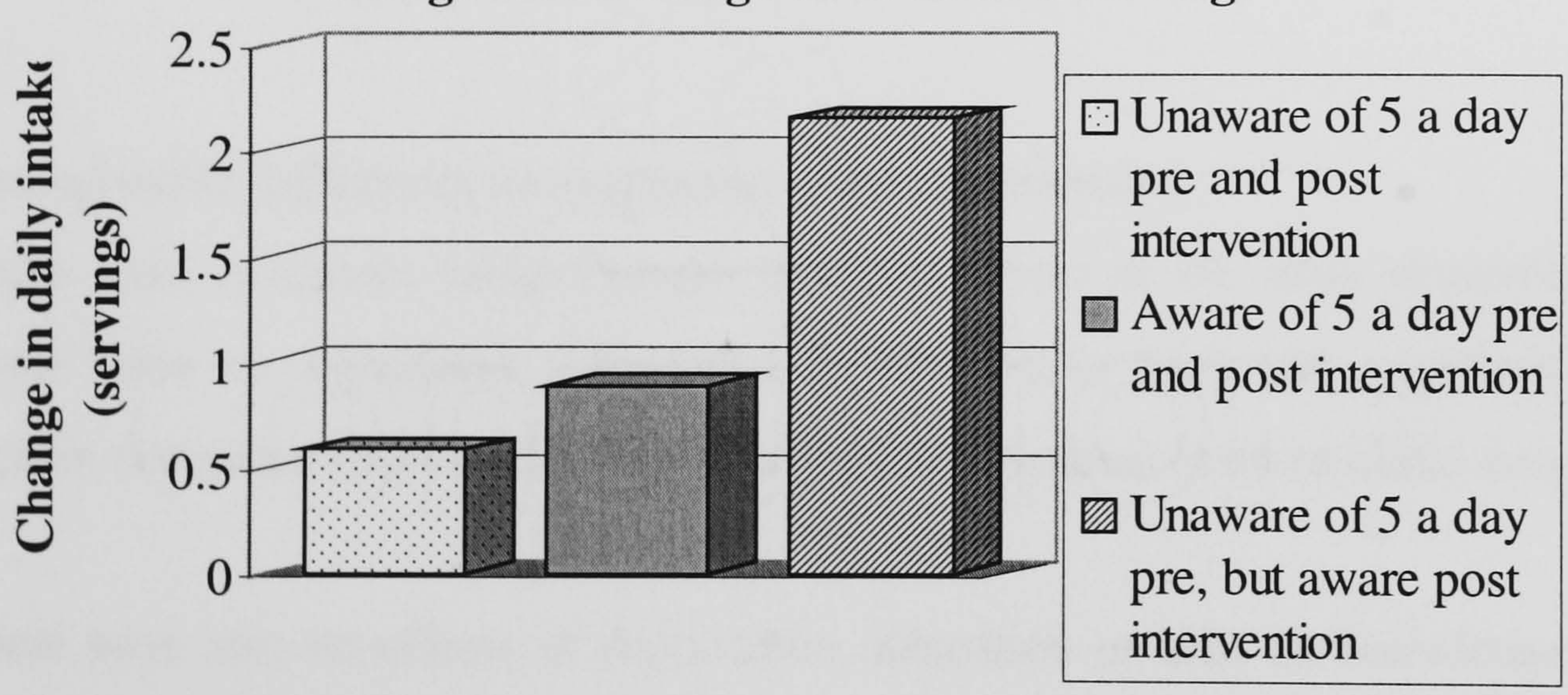
At follow-up significantly more participants in the intervention group perceived their intake of fruit to be adequate than in the control group (χ^2 = 5.51, df[2], p<0.05) although there were no significant difference in rating for vegetable intake.

Processes of change in the intervention group

The associations between changes in behaviour and changes in knowledge and attitudinal factors were examined with correlations and ANOVAs. There was a significant correlation between changes in total daily intake and changes in estimated recommended servings for both the intervention group (r_p= 0.28, p<0.001).

To look at the impact of knowledge acquisition on change in total daily intake, three groups were identified: participants who did not know the recommended level before or after the intervention (no change), participants who knew about recommended levels before and after the intervention (no change) and participants who did not know about recommended levels before but did know after the intervention (knowledge change). There were significant differences between the groups with the knowledge change group making the largest increases in consumption of fruit and vegetables (Anova [2, 290], F= 18.9, p<0.001). However when looking at acquisition of knowledge about the association between consumption and disease there were no significant difference (Anova [2, 205], F= 0.80, p=ns) between participants who changed their knowledge (did not know before but did after the intervention) and those whose knowledge did not alter (either did not know before or after the intervention or did know before and after the intervention).

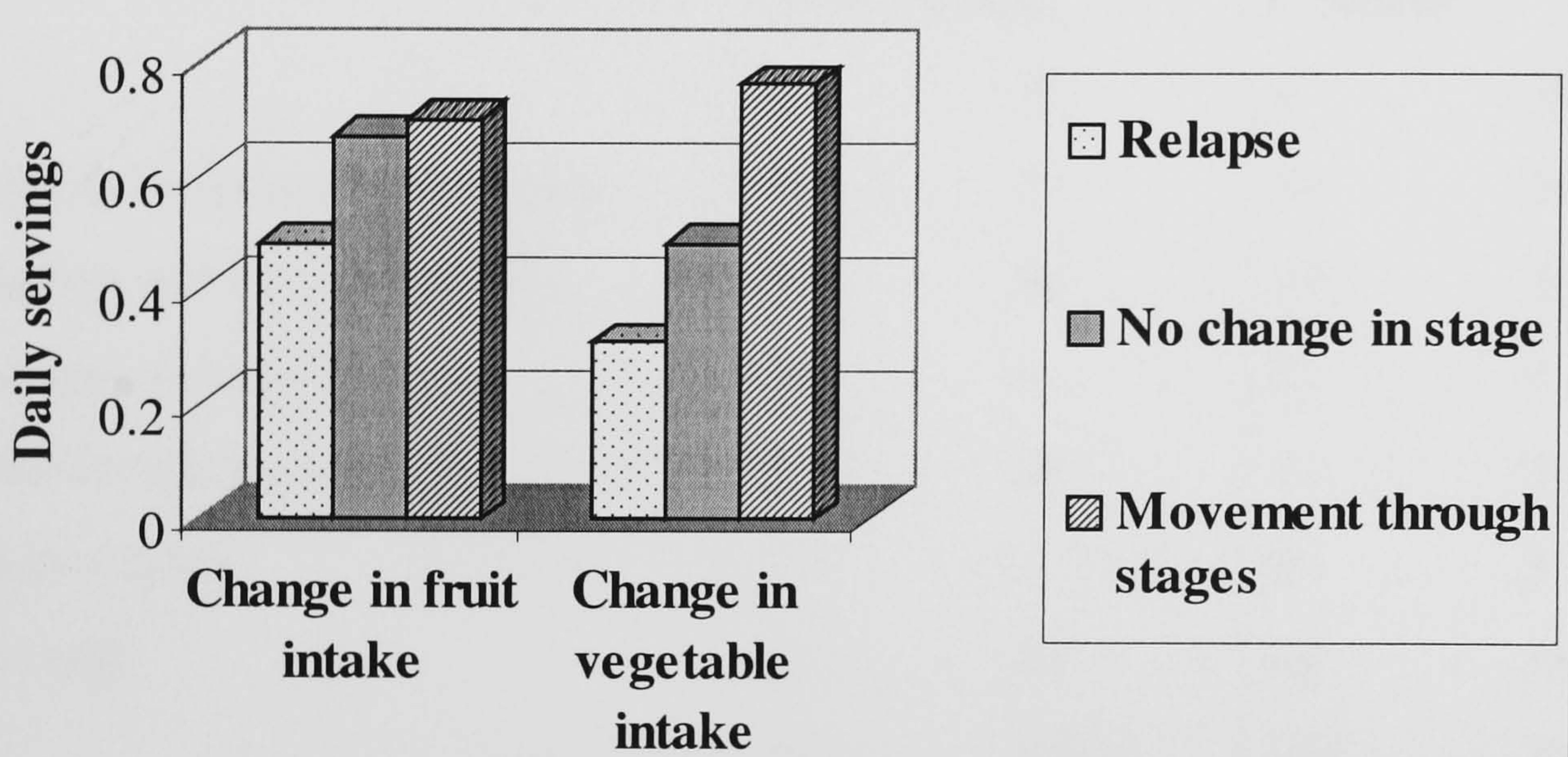
Figure 5 Change in total daily fruit and vegetable intake by change in knowledge of estimated servings



There was also a significant correlation between change in attitudes to fruit and fruit intake (r_s = 0.13, p<0.05) and between change in attitudes to vegetables and vegetable intake (r_s = 0.15, p<0.05).

Changes in intake were examined by change in stage of change in the tailored intervention group. Participants were categorised as those who had 'relapsed' (going from a higher stage of change to a lower stage of change), made no change or had progressed along the stages of change. The results indicate that participants who made a positive change in stage of change made larger increases in vegetable intake. (F df[2, 288], = 3.04, $p<0.05$). The results are not significant for change to fruit intake although participants who changed their stage of change made slightly greater increases in fruit intake (F df[2, 298], = 1.00, p=ns) as illustrated in Figure 12.

Figure 6 Change in intake by changes in stage of change for fruit and vegetables



Demographic influences on responses to the intervention

These were examined using changes in intake levels as the main dependent variable. There were no significant differences in changes in fruit and vegetable intake, by gender, economic deprivation, highest achieved education level or clinic area.

There were also no effects of deprivation, education or area on knowledge or attitude change except that men improved more in their knowledge about recommended servings ($t=2.10$, df[340], $p<0.05$).

Features of the leaflet

Both intervention and control participants were asked about interventions. Control participants were asked hypothetically, whilst intervention participants were asked about the intervention they had received. They were asked to rank the importance of 6 different features of a proposed leaflet for the control group and actual leaflet for the intervention group. Due to misinterpretation some participants selected more than one category as the highest, therefore for this analysis only those who managed to rank the answers from 1-6 are included. 69% (440) of the sample were able to answer the ranking questions correctly.

Table 21 Proportion of characteristics of an intervention leaflet ranked 1st

	Intervention		**Control**	
	n	**%**	**n**	**%**
Information on increasing intake	45	21	46	20
Information on diet and health	84	40	121	52
Information on serving sizes	18	9	8	3
Personalised for each person	37	18	17	7
Printed in colour	3	1	8	3
Easy to read	22	11	34	15
Total	209	100	234	100

Using a Mann-Whitney U Test the data were examined for significant differences in ranking of the features listed. The data show that people in the intervention group ranked 'colour' ($n=440$, $Z=-4.27$, $p<0.01$) and 'personalised for me' ($n=440$, $Z=-5.52$, $p<0.001$) more highly than the control group. The control group ranked information on 'diet and health' as higher ($n=440$, $Z=-3.13$, $p<0.05$) than the intervention group. There were no significant differences in the other 3 features listed.

Other sources of information

Participants were asked about other sources from which they had received information on eating more fruit and vegetables. There were no significant differences in the proportion of people who had read or heard information about fruit and vegetables from another source (74% in the intervention compared to 71% in the control group). The main sources for information were the media with 36% of participants getting information from newspapers, 39% from magazines and 37% from radio and television. Medical setting such as hospitals (12%), dieticians (8%), dental clinics (5%) and GP surgeries (19%) were also sources of information.

There were no significant differences in proportions of control and intervention participants for any sources of additional information about fruit and vegetables apart from radio and television. Significantly more participants in the control group said that they had heard or seen information about eating more fruit and vegetables on TV and radio than the intervention group (χ^2 df[1], F= 7.29, p<0.01).

Table 22 Other sources of information about fruit and vegetables

	Intervention		**Control**	
	n	**%**	**n**	**%**
Any source	244	76	233	74
Newspapers	118	37	113	36
Magazines	126	39	124	39
Radio /Television	104	32	134	43
Family	34	11	25	8
Friends	26	8	20	6
Shops	50	16	41	13
GP surgery	63	20	61	19
Hospital	34	11	41	13
Dental clinics	17	5	18	6
Dietician	23	7	27	9

There were significant differences in intake of fruit (t=-2.03, df[631], p<0.01) and vegetables (t=-2.62, df[629], p<0.01) between those responders who had heard or seen information else where and those who had not. However there were no differences in attitudes towards fruit and vegetables or knowledge about recommended servings. See Table 23 for changes in behaviour, attitudes and knowledge by additional information.

Table 23 Changes in behaviour, knowledge and attitudes by alternative health information				
	No information		Other information	
	Mean	s.d.	Mean	s.d.
Fruit intake	0.24	1.12	0.47	1.27
Vegetable intake	0.16	0.90	0.40	1.24
Recommended servings	0.45	1.96	0.50	1.77
Attitudes to fruit	0.75	0.31	0.04	0.34
Attitudes for vegetables	0.01	0.31	0.01	0.30

Comments

Participants were given the opportunity to give comments and approximately 9% (55) did so. This section was added to ensure that respondents had the opportunity to put down on paper things if they wished to and not as any formal mean of evaluation, however analysis of the comments indicate some interesting features. The most regular comments were about the usefulness of the information sent, requests for additional information and information about why people have not been able to change. Out of 55 comments there were only 2 negative ones where people felt the intervention did not present them with additional information. There were 35 (62%) positive comments about the intervention and how it had had an impact on attitudes or behaviour such as 'Thank you for your personal leaflet which is most helpful and informative. It's helped me in increasing my fruit and vegetable intake" and "the fact it was personalised was also helpful". There were also 5 (10%) of participants who requested additional information including genetic modification, more depth about antioxidants, organic foods and nutrients. Seven respondents spoke about barriers to change with money being the one mentioned most with quotes such as "my fruit and veg bill comes to £7 a week which is expensive for a pensioner".

Summary of results

The aim of this study was to examine the efficacy of a tailored intervention in changing behavioural and psychological factors associated with intake of fruit and vegetables, the premise being that changing psychological factors will lead to changes in intake. Therefore the intervention focused on increasing nutritional knowledge and enhancing positive attitudes towards fruit and vegetables. It was found that there were positive changes in knowledge with intervention participants increasing their knowledge about recommended levels of intake and knowledge about diseases related to consumption. Associated with this were also positive changes in attitudes to fruit. There were greater increases in intake of both fruit and vegetables in the intervention group, than the control made some.

Discussion

This chapter looks at the efficacy of a tailored intervention in changing knowledge, attitudes and dietary behaviour. The literature on tailored interventions suggest that this is a more productive method of encouraging behaviour change than using interventions which are the same for everybody (Brug et al, 1998; Dijkstra et al, 1998). Tailored interventions enable researchers do administer programs which are individually relevant without the need for personal contact. These rely on the use of advanced computer technology in interpreting and using individual information to produce the personally tailored interventions. However although the work on health behaviours and certain dietary behaviours have been favourable, the evidence of impact specifically for fruit and vegetables is not so clear. Therefore this study focused only on attempting to change fruit and vegetable intake. One of the possible reasons why other dietary studies (Campbell et al, 1994, Brug et al, 1996) have not managed to change fruit and vegetable intake is the focus on other dietary behaviours at the same time (e.g. reducing fat intake). This study also used nutritional knowledge to tailor the intervention based on the associations found in earlier analysis. Using these new ideas the intervention was tested in comparison to no intervention in the selected sample. As well as the behavioural changes desired, it was also important to see whether positive changes could be made to the psychological factors addressed in the intervention.

As has already been discussed the sample used in this study were not representative by virtue of their age and also health motivations by attending for cancer screening. This may have contributed to the high level of interest (76%) in the intervention as indicated by desire for more information and giving of addresses. Individuals taking part in the intervention study were reasonably representative of the screening population as measured by demographic, behavioural and psychological characteristics. However this does not give us insight into the factors which motivated certain participants to ask for information or not. This indicates that there were other reasons than the ones measured in this study which were related to interest in receiving more information. There may possibly have been issues relating to concerns over confidentiality and giving of personal information although attempts were made to counteract this. It is useful to know that the main outcome variables do not effect levels of uptake in the intervention study.

As well as possible differences in participants taking part in the intervention, it was important to look at any possible differences between responders and non-responders as this may have an impact on the perceived efficacy of the intervention. Sending the intervention itself may have had an impact regardless of content. In the control group, fewer men and less from lower SES group responding to the follow-up questionnaire, while non-responders also consumed fewer servings of vegetables at baseline. This may indicate that these groups may be more inclined to drop out of intervention programmes, so more effort may be required to ensure continued participation. In the intervention group the only significant difference between responders and non-responders was the stage of change measure with more responders being in the maintenance stage at baseline.

The high interest rate in receiving more information suggests that cancer-screening clinics are a good setting in which to get actively motivated participants to take part in dietary intervention studies. It has already been discussed in the baseline discussion section that this group of participants are a highly selected group being both attendees in a selective national screening program and aged between 55 and 65 years of age. Initial concerns about interest levels in older adults have been proved groundless. Future intervention programs should not dismiss participants based on age alone. Cancer screening setting are useful in gaining information about participants in intervention programs but also gaining information that can be used to design more appropriate tools for change.

There were large increases in nutritional knowledge in the intervention group with significantly more people able to correctly identify the number of recommended servings, and more people being aware of the links of fruit and vegetables with cancer and heart disease. The low levels of knowledge about recommended amounts and the health benefits of fruit and vegetable consumption at baseline indicated that this was an important area to focus upon. Participants in this study were able to sustain their increased knowledge at 6 weeks, but it would be interesting to assess whether increases in knowledge could be sustained in the long term. It was encouraging to find that the majority of people were now aware of the messages about recommended levels and health benefits. However it would be interesting to find out why approximately 30% of the sample did not remember or pick up this information. At the same time participants in the control group also increased their knowledge somewhat. This may have been because of heightened awareness of issues to do with fruit and vegetable intake as a result of completing the baseline questionnaire or alternatively because of asking for more information. Control participants were not sent an intervention until after final data collection so may have actively sought alternative information in the meantime. Nevertheless the intervention was successful at raising awareness of health recommendations and health benefits of eating fruit and vegetables.

Interestingly there were also changes in attitudes to fruit for all factors apart from price. This is very encouraging to see that intervention participants were more positive about fruit at follow-up. Surprisingly there were no changes in attitudes to vegetables on any factors. It may be that attitudes to vegetables are more embedded than attitudes to fruit. However although not significant there was a positive trend in attitudes for vegetables. The results indicate that giving people information to counteract negative attitudes can have an impact on attitudinal factors. There is a tradition to combine fruit and vegetables in investigations of dietary behaviour, but these results suggest campaigns to encourage people to eat more fruit and vegetables might consider focusing on them independently.

There were also favourable changes in participant's rated stages of change from baseline to follow-up. The majority (78%) of intervention participants intended to eat more or had started to eat more fruit compared to only 53% in the control group whilst 41% intended to eat more or had started to eat more vegetable compared to only 29% in the control group. The data show that the intervention had substantially stimulated intention to change when compared to a group receiving no material.

The main aim of the intervention was to change intake of fruit and vegetables. The majority of participants receiving the tailored intervention increased their daily fruit (69%) and vegetable intake (65%) with nearly half now eating health recommendations of at least 5 servings of fruit and vegetables a day at follow-up. There were also significant but modest changes in fruit and vegetable intake for the control group, which could be due to seasonal variations (Ziegler *et al*, 1986), or possibly to raised awareness and interest prompted from the baseline questionnaire. The control group had requested more information about adopting a healthy diet so might have been more motivated to change.

One of the problems with analysing the data in this method is that it does not take account of the possible effects of the intervention on people who did not respond to the follow-up questionnaire. Therefore an 'intention to treat analysis' was carried out to look for behavioural changes between the intervention groups. This type of analysis is used mainly in clinical randomised control trials to test the impact of an intervention on all participants initially randomised in the trial, as opposed to only those who respond at follow-up. It is useful for looking at possible change of non-responders or those who drop out of an intervention study. For the purpose of this analysis we wanted to look at what happened to the two groups randomised to intervention or control overall at follow-up. Due to the high response rates it was likely that positive results obtained would be sustained in this type of analysis. All participants who volunteered to take part in the intervention study but failed to return the follow-up questionnaire were allocated a follow-up intake level based on natural changes in intake of the control group at follow-up. Using this method it was found that there was still a significant impact of the intervention on intake of fruit and vegetables. It can be concluded that the intervention group as a whole made greater changes to intake levels even if they did not respond to the follow-up assessments.

The results from the follow-up data indicate the efficacy of the intervention in changing not only psychological factors but dietary intake as well. The positive increases in intake levels are impressive in comparison to the other 'tailored intervention' studies which have had more minor changes, if at all (Campbell et al, 1994, Brug et al, 1996, 1998, 1999a). Further understanding is needed to appreciate why and how these changes came about.

Although there were significant changes in intake, it was important to understand why this occurred. The intervention itself is a progression from earlier intervention studies because it combines different characteristics, which have been shown to be relevant or successful in change. These include focusing on two related behaviours, adding knowledge as a component for change and tailoring of the intervention.

There may have been some influence on eating behaviour as a result of sending the questionnaire alone because it reminded people of issues to do with fruit and vegetable consumption, which may account for the small changes in intake for the control group. The significant increases in both fruit and vegetables in this study, compared with other investigations more modest effects, indicate that focusing on two related behaviours (fruit and vegetable intake) can have a bigger impact than combining these with other eating behaviours such as decreasing the amount of fat in the diet. Two other tailored intervention studies by Brug *et al* (1996) and Campbell *et al* (1994) attempted to address reduction of fat with increasing fruit and vegetables, with no impact on fruit or vegetable intake. Alternatively Marcus *et al* (1999) found that an intervention focusing on only increasing fruit and vegetables whilst excluding reduction of fat can have positive results on the outcome behaviours. Using a simple format whereby the act of behaviour change is in the same direction; positive enhancement instead of risk reduction appears to make changes of both easier. It may be that motivation to increase one dietary behaviour is increased by positive changes in a similar behaviour. Although fruit and vegetables are easier to identify in the diet than fat for example, increasing the amount of fruit and vegetables may be associated with additional cost and readjustment of food plans. The psychological processes involved in 'positive enhancement' as opposed to 'risk reduction' are very different. It may be important to consider the consequences of asking people to increase certain foods, because this may lead to increases in body weight if they are not substituting these for other foods. It would also be interesting to see whether increasing fruit and vegetables leads to a reduction in the amount of fat in the diet. The indications are that asking people to make fewer changes to behaviour is likely to be more successful than requesting wide varied changes.

The use of a tailored and personalised intervention was important when attempting to change behaviours, which in the past have been difficult to influence. Using a tailored and personalised intervention takes account of an individual's present behaviour and psychological status, and gives appropriate information to begin change. In designing the intervention, care was taken to ensure that the intervention appeared personalised to those taking part. Not only does this have the impact of making people believe that the intervention is specific to them but also is likely to be more salient to them. Through out the text, there was emphasis on the person by repetition of their name and language written for the 2nd person. This meant that participants were reinforced about their answers given at baseline and that recommended changes to be made were directed personally at them. The tailoring aspect was designed to take account of both behavioural and psychological baseline measures. Information given therefore reflected people's opinions and answers at baseline. Clearly giving people specific information is more motivating than giving general information, which does not apply to them or may seem contradictory to their beliefs. This intervention focused on improving participants' nutritional knowledge to give them the knowledge base to consider why and how to make changes. Informing participants about the amount they should be eating is an important foundation for change. However this relies on people being motivated for change. Therefore this intervention used information specific to participant's stage of change as a means of motivation. The stage of change processes have already been shown to be effective in changing smoking behaviour by working with intention, self-efficacy and perceived barriers (Prochaska *et al*, 1986). For example those who had no intention of change were told about the benefits of change. By targeting the processes used in behaviour change meant that a variety of factors associated with change could be addressed. Attitudinal information was used to reduce perceived barriers by educating people about alternatives. If the perceived barriers were larger than the benefits for changes then change was unlikely to have taken place. Therefore a better understanding of the individual barriers to change need to be investigated. The personalisation and tailoring contribute to the large effects on behaviour, knowledge and attitudes from the intervention. This process takes account of possible differences between individuals at baseline and ensures that advice is appropriate.

By looking at the association between changes in behaviour and changes in psychological factors, it is possible to gain a more insightful understanding of the processes involved in change. Herron (1991) suggests that strategies for promoting healthy dietary behaviour should emphasise reliable, up-to-date nutritional knowledge that supports guidelines for healthy eating. It is clear that changes in knowledge about recommended servings are an important factor associated with change in consumption of fruit and vegetables. Those participants, who knew about the 5 a day message at follow up but did not at baseline, made the greatest changes in intake. There were however no differences in change of intake, when examined by change in knowledge about disease. Acquisition of knowledge about the health benefits of fruit and vegetables was not associated with change in intake. Perhaps certain aspects of nutritional knowledge are more pertinent for behaviour change than others. It is important that, before participants can decide to change, they need the knowledge about the goals that they are aiming to achieve. Also it was found that although only changes in attitudes to fruit were detectable in the group as a whole, changes in both attitudes to fruit and vegetables were associated with changes in behaviour. These results indicate that both knowledge and attitudes are involved in the change process. However it appear that knowledge may work directly on behaviour as well as impacting on attitudes which in turn effect behaviour. Additionally the results indicate that progressing through the stage of change is associated with more positive changes in behaviour. Thus whilst it may not be a good predictor of behavioural and psychological factors it is linked to change of these.

There has been little research which has looked at gender differences in changes to outcome, in intervention studies with none for dietary interventions. Therefore we can not know whether men and women react differently to interventions because of other factors. The clear differences in knowledge and attitudes by gender characteristics could indicate that men and women interpret information differently. However there were no gender differences in change levels for the majority of behavioural and psychological measures. Therefore it seems that men and women make similar changes when receiving information appropriate to them. This indicates that if men are targeted in interventions then they can make changes to their intake levels, as well as to knowledge and attitudes. The only measure where there was a significant difference in change was for estimates of health recommended servings, where men made significantly greater changes in knowledge. This is not totally unexpected, as their knowledge levels were lower at baseline. In the future increasing nutritional knowledge in men would be a useful foundation for overall behavioural change.

Cancer screening clinics might be especially good settings for cancer preventive advice because messages about diet and health are intertwined with other risk factors for disease. Giving information about the link between fruit and vegetables and cancer at a salient time is likely to have a bigger and longer lasting impact. Other clinical settings could be considered for obtaining and administering dietary information because participants may be more salient to receiving health behaviour information. The

WISEWOMEN project (1999) in the US is currently looking at the feasibility of using breast and cervical cancer screening clinics as an opportunity to administer advice about coronary heart disease including dietary advice.

A comments section was added to the follow-up questionnaire as a means for participants to elicit ideas and suggestions about the intervention and study overall. The majority of comments were very positive about the intervention. These focused on the personalisation of the leaflet and also the knowledge gained from new information. The information about health and diet, and serving sizes was especially appreciated. There was also a desire for more information in more depth. The negative comments referred to the simplicity of the intervention and lack of new information. However it is very difficult to gauge information in a large-scale intervention study to the appropriate academic level. It was interesting to note that people were interested in other areas relating to fruit and vegetables intake. The newest area of concern was genetic modification. People were interesting in acquiring new knowledge to guide their behaviour. Genetic modification has been in the news a considerable amount in recent years since publication about the possible negative effects from eating genetically modified food. There appears to be a lack of knowledge about the effects and also what genetic modification means. This indicates that knowledge especially unknown knowledge can play an important part in the decision making about food. There may be a fear that exists regarding genetic modification, which is preventing some people from eating adequate amounts of fruit and vegetables. Increases in knowledge would therefore be desirable to allow people to have adequate information to make their own food choices.

The effectiveness of this tailored intervention now needs to be tested against a general intervention to see if the impact is due to the 'tailoring' aspect or the intervention itself. The sample was well educated with fewer people coming from lower socio-economic levels. Having conducted this in a clinical setting, the intervention would also benefit from being tested in a more representative setting. It is important to improve the diets of those who are more economically deprived, as well as not only targeting those who are most motivated for change.

Basic information giving in a clear and simple form can be an effective way to change psychological factors and in turn behaviour as has been shown. Knowledge, attitudes and stage of readiness to change have been shown to be important factors that mediate change. The effect of tailoring can only be hypothesised as this was not tested against a non tailored intervention. However improving the levels of nutritional knowledge and enhancing attitudes to food has been shown to be directly related to change in intake. A combination of several intervention characteristics which were focusing on two similar behaviour (fruit and vegetable intake), addressing low knowledge and poor attitudes and tailoring to individual beliefs and perceptions have been successful in instigating change in this sample. The large effects in this study are encouraging and further investigations in subsequent chapters will go further to explaining the role of a tailored intervention in dietary change by comparing it to a more general intervention which is the same for everybody in a less motivated and age specific sample.

Chapter 6 Psychosocial predictors of fruit and vegetable intake in dental attendees

Introduction

In this chapter we replicate the investigations from Chapter 3 which looked at psychosocial predictors of fruit and vegetable intake in cancer screening attendees using knowledge and attitudes to predict behaviour. This study aims to see whether there are as strong associations between knowledge, attitudes and behaviour in a sample of wider age range, recruited from dental clinics around London. It also looks at whether the poor intake levels, low nutritional knowledge and negative attitudes can be generalised to samples from other health-related settings.

The types of people who attend dental clinics are described in the ONS General Household Survey (1995). This indicates that more women (61%) visit the dentist regularly than men (47%), and people aged between 35 and 64 years were most likely to attend for regular check ups at the dentist than those aged under 35 years. In the non-manual socio-economic groups, 61% reported attending for regular check-ups compared with less than half (46%) from manual groups. Approximately equal proportions of men are in the manual (46%) and non manual (45%) working groups, although twice as many women are in the non manual working group (56%) compared to the manual group (28%). This suggests that this sample is going to be from a more varied age group but may have a bias towards women from higher SES backgrounds.

Research has shown differences by gender, age, smoking status in a variety of different health behaviours. Some research shows that older people are more inclined to eat a more healthy diet (McClelland *et al*, 1998) but does not propose a reason why this may be. Smoking status has also been linked consistently to diet. Fehily, Philips and Yarnell (1984) found that although smokers did not have differences in energy intake, they tended to have lower intake of nutrients, mineral and dietary fibre which could largely be due to lower intakes of fruit and vegetables. Morabia and Wynder (1990) also found that smokers consumed fewer fruit and vegetables than non-smokers. Understandings of why this may occur are restricted and there has been little investigation to look at whether smokers have different levels of knowledge or different attitudes, which may contribute to the lower levels of intake.

Additional attitude factors have been added to the study covering transportation, health, and weight control satisfaction. These have been included to investigate whether these factors are specific to different demographic groups (e.g. men and women), and to see if we can determine the possible reasons why there are such clear gender differences in intake levels.

Basic design as before. Baseline data collected to look at factors associated with fruit and vegetable intake and to gather material for the intervention study. Using the additional demographic factors, we will look at the association of knowledge and attitudes with behaviour taking account of possible demographic differences.

Methods

Participants for this study were drawn from adults (aged 18-70) attending dental clinics across London. There were 6 clinics involved in the study, 2 from south London, 3 from north London and 1 one from central London. These were selected through professional connections with University College London. One clinic approached did not agree to take in the study because it was already conducting research of its own. All clinics accepted National Health Service patients and they were from different socially diverse areas of London. When parents were attending for the treatment of their children, they were invited to complete the questionnaire if they were patients of the practice.

Procedure

Participants were initially approached by clinic staff or a researcher and asked whether they would mind filling in a questionnaire about their diet. This was usually completed whilst waiting for their appointment. Participants were permitted to take home questionnaires if they were prepared to return them in a FREEPOST envelope provided.

Development of questionnaire

Piloting of the questionnaire had been conducted before in the cancer screening study and in several dental clinics. Additional piloting was done with approximately 40 patients to test a modified version of the questionnaire. Changes to the questionnaire are discussed below.

The questionnaire was based on the one used in the cancer screening study. Changes to the questionnaire occurred as a result of data analysis, which suggested that some factors had poor relationships to the factors being measured. Additional factors were added to refine the questionnaire.

Measures

The following aspects of dietary behaviour were assessed on the questionnaire. (See Appendix 4 for questionnaire)

Intake

As before participants self-rated their own intakes for both fruit and vegetable by ticking one of 8 boxes indicating frequency of consuming servings e.g.

(0-2 a week / 3-4 a week / 5-6 a week / 1 a day / 2 a day / 3 a day / 4 a day / 5 a day)

The frequency options were altered from the first study to give a more precise estimate in the range than 2 to 3 servings a day. There were now fewer categories for less than 1 a day. The number of glasses of fresh fruit juice per week was also added.

Perception of adequacy of intake was assessed by asking participants whether they thought they ate 'too much', 'about right' or 'not enough' fruit and vegetables, as before.

As before, participants were also asked if they were on a diet and if so, the type of diet were also recorded. Weight loss, vegetarian and diabetic were given as examples.

Attitudes

Questions covered convenience[(1)], taste[(2)], price[(3)], storage[(4)], ease of preparation[(5)] and availability[(6)] as before. In addition, 'filling'[(7)], 'good for weight control'[(8)], 'bad for you'[(9)], 'healthy'[(10)], 'portability'[(11)]. Again four point Likert scales from 'strongly agree' to 'strongly disagree' were used. See Table 67.

Table 1 Attitude questions	
(1)	Fruit/Vegetables make a convenient snack
(2)	Fruit/Vegetables taste delicious
(3)	Fruit/Vegetables are expensive
(4)	Fruit/Vegetables don't keep very well
(5)	Fruit/Vegetables take a long time to prepare
(6)	Good fruit/vegetables can bought at my local shops
(7)	Fruit/Vegetables are not filling
(8)	Fruit/Vegetables are good for weight control
(9)	Fruit/Vegetables are bad for you
(10)	Fruit/Vegetables are healthy
(11)	Fruit/Vegetables are difficult to carry around

These items were selected based on literature about negative attitudes related to intake. Some items were added to cover factors that emerged from discussions with people at the piloting stage of the 2nd questionnaire.

Nutritional knowledge

Modified versions of the questions used in the flexiscope study were used in the dental study. The topics covered include specific items on; the link between fruit and vegetables and major diseases, the number of health recommended servings, knowledge about antioxidants and estimations about the vitamin, fibre and calorie content of fruit and vegetables. Participants had to indicate whether they knew of any major diseases relating to intake of fruit and vegetables. If they selected 'yes' this was counted as correct. Additionally participants were asked to name any disease or health problems that they were aware of. Participants were asked as before *'how many servings of fruit and vegetables (combined) per day do health experts recommend?'.* Those who selected 5 or more servings a day were classified as correct.

Participants also estimated levels of vitamins, fibre and calories in fruit and vegetables in general, by selecting different ratings *e.g. low medium high.*

Selecting high for vitamins and fibre content was counted as correct, as was selecting low for calorie content.

Participants were also asked whether they had heard of antioxidants and classified as correct if they had.

Background Information

Demographic measures

Demographic questions include age, gender, ethnicity, educational level, car ownership, home ownership and work status as in Study 1. Additionally participants were asked about smoking activity and whether they had children under 18 years living at home.

Anthropometric measures

Self reported weight, and height were recorded to calculate BMI.

The questionnaire was marginally shorter than the baseline questionnaire used in Study 1. It took approximately 10 minutes to complete. Again a description of who was conducting the study and why, with reassurance of confidentiality was given. A contact name, address and telephone number were also given.

Results of baseline data

The sample of respondents comprised 1846 patients attending dental clinics across London. 17 respondents were excluded from the data analysis for not meeting the age criteria of 18 years of age or over. Approximately 90 people did not complete the full questionnaire due to lack of time, but their other data been included in the preliminary data analysis.

There were good response rates for questionnaire completion. Approximately 5% of people asked at the clinics declined to fill in questionnaires (as observed by researcher). Reasons most frequently given were lack of time or inability (i.e. poor eyesight or age) with no apparent demographic differences. See Table 2 for clinic sample characteristics.

Table 2 Clinic characteristics

Clinic	Area	Number of dentists	Number	% of total sample
1	Camden	2	217	12
2	Streatham	4	248	14
3	Barnet	1	254	14
4	Archway	1	192	10
5	Lambeth	4	774	42
6	Muswell Hill	1	159	8

The clinics used were both single handed practices (e.g. 1 dentist and an occasional hygienist) and practice clinics (e.g. more than 1 dentist and a regular hygienist). Piloting of questionnaires highlighted the diversity of attendees (state benefit being used as a simple index of deprivation). The majority of the sample (42%) came from one clinic, which was a consequence of the management of the clinic as opposed to differences in interest levels. This clinic had an especially high attendance by people on receipt of state benefits (as observed by researcher). Because of the geographic location of some of the clinics a large proportion of the other attendees were commuters and thus more likely to be from higher SES groups. All clinics used in the study had both NHS and private patients.

Sample characteristics

Demographic characteristics

The sample of 1846 included 654 (38%) men and 1075 (62%) women, with an age range of 18 to 87. There was a mean age of 42.7 (s.d. 13.94) years. The majority of participants were between 25 and 64 years of age (72%). Men and women were comparable in age (χ^2=6.96, df[5], ns), ethnicity (χ^2=7.41, df[3], ns), highest education level (χ^2=20.48, df[4], ns) and socio-economic deprivation level (χ^2=1.03, df[2], ns), but more men worked full-time (χ^2=125.85, df[5], p<0.001). See Table 3.

Table 3 Distribution of demographic characteristics of sample

	Men		**Women**	
	n	**%**	**n**	**%**
	654	**38**	**1075**	**62**
Age				
18-24	46	7	70	7
25-34	160	25	273	26
35-44	163	25	291	28
45-54	129	20	229	22
55-64	89	14	112	11
65+	64	10	83	8
Mean age	43.5 ±	14.48	42.2 ±	13.57
Qualifications				
Primary	18	3	16	2
Secondary	159	25	320	31
Trade	92	14	97	9
Diploma	66	10	136	13
Degree	300	47	469	45
Work status				
Working full-time	416	66	501	48
Working part-time	36	6	188	18
Not working	66	10	68	7
House wife/husband	9	1	114	11
Retired	67	11	97	9
Student	37	6	78	7

Table 3 continued				
Economic deprivation				
High	99	17	167	18
Medium	316	55	518	57
Low	156	27	229	25
Car ownership				
No car	167	28	280	29
Car	434	72	693	71
Housing tenure				
Home owner	394	65	657	67
Other	210	35	325	33
Children				
None	454	69	710	66
1	65	10	159	15
2	104	16	144	13
3	21	3	44	4
4+	10	1	18	1
Smoker				
No	419	70	715	73
Yes	180	30	263	27

The majority of the sample were reasonably well educated with 46% having a degree or equivalent. This compares with approximately 14% of the UK population having a degree (DfEE, 1999). 54% of participants were working full-time, with 8% not working. The majority were 'white' (86%), with 5% 'black' and 4% 'asian'. This sample has a higher percentage of non-white participants than the UK population (94%) which reflects the areas of London used.

Socio-economic deprivation indexed by car ownership and housing tenure (scoring 0-2) show that over half (56%) were from lower deprivation levels (i.e. were homeowners with a car). The higher numbers of people with higher deprivation scores could be due to the nature of London's population, whereby young adults (20-30 year olds) rent properties and do not own a car. However a larger proportion of this sample owned a car (72%) compared with London as a whole (61%)(ONS, 2000).

33% of the sample had children under the age of 18 living in their household. 28% of participants classified themselves as smokers.

Anthropometric measures

Respondents reported their height, weight and whether they were on a diet, and if so, the type. Body Mass Index (BMI); kg/m^2 ranged from 15 to 41 with a mean of 24.02. 67% of the sample had a BMI of below 25, with 25% overweight and 8% of participants being classified as obese. Men had a significantly higher BMI than women (df[1600], t= 6.89, $p<0.001$), with more men being classified as obese (10%) (χ^2=65.3, df[3], $p<0.001$). A minority (19%) of the total sample were on a diet. Significantly more women were on a diet than men were (χ^2 =23.8, df[1], $p<0.001$). The most common type of diet was vegetarianism followed by weight loss. There were no differences in type of diet between men and women. Table 4 displays a breakdown of BMI and differing dietary habits.

Table 4 Body Mass Index and diet history for men and women

	Men		**Women**	
	n	**%**	**N**	**%**
Body Mass Index (BMI)				
<25 (normal weight)	350	57	728	73
25-29.99 (over weight)	201	33	192	20
30 + (obese)	60	10	71	7
Height (cms)	177.4±	8.3	164.2±	7.0
Weight (kg)	78.3±	12.8	63.4±	11.0
BMI (m/kg^2)	24.9±	3.7	23.5±	4.0
Diet				
No	479	86	680	76
Yes	76	14	218	24
Type of diet				
Weight loss	12	13	55	22
Vegetarian	43	52	112	45
Diabetic	10	12	11	4
Low fat	5	6	34	14
Other	12	15	36	15

Fruit and vegetable intake

Distribution of weekly fruit and vegetable servings are illustrated in Figure 1 for fruit and Figure 2 for vegetables.

Figure 1 Distribution of servings of fruit

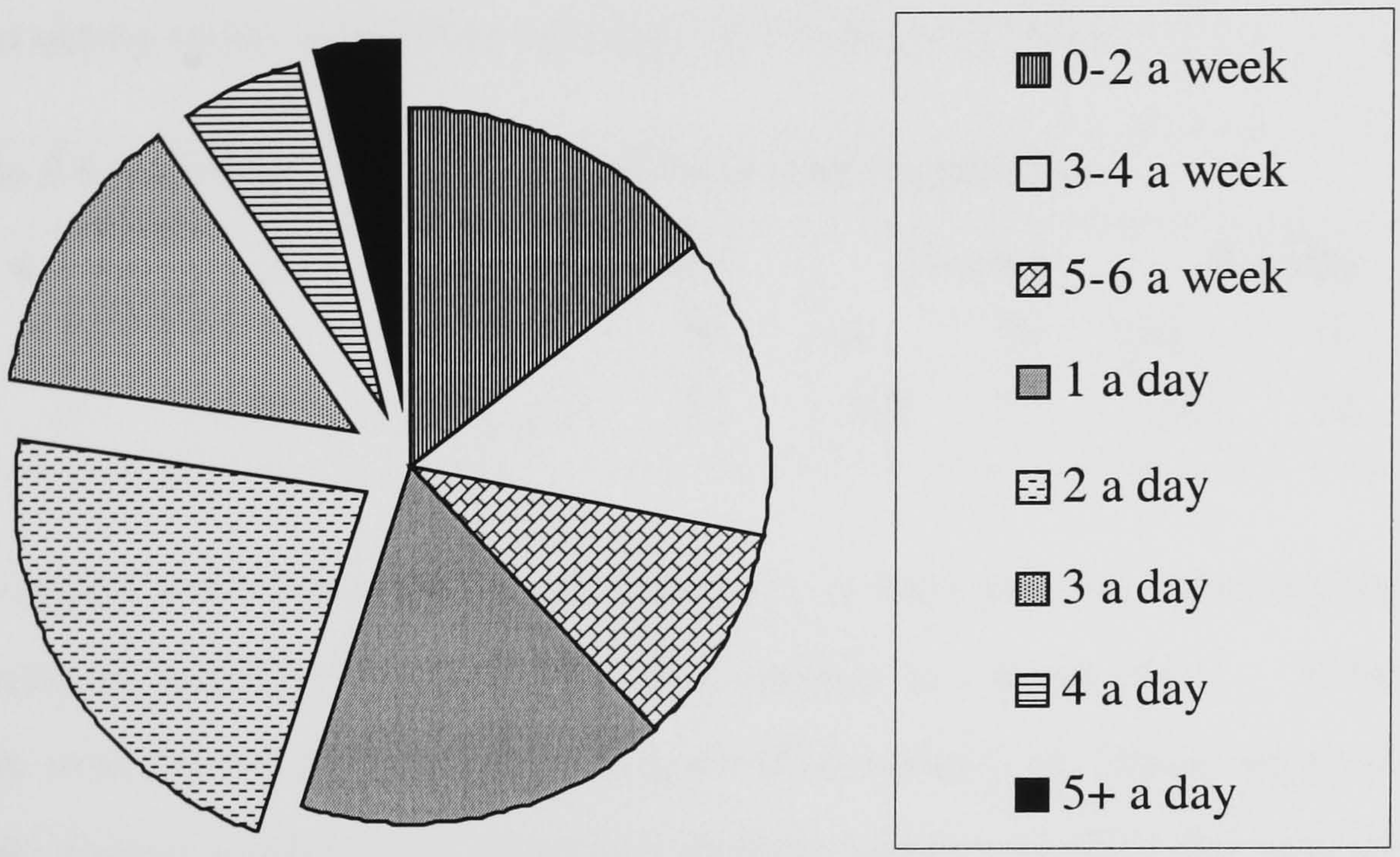
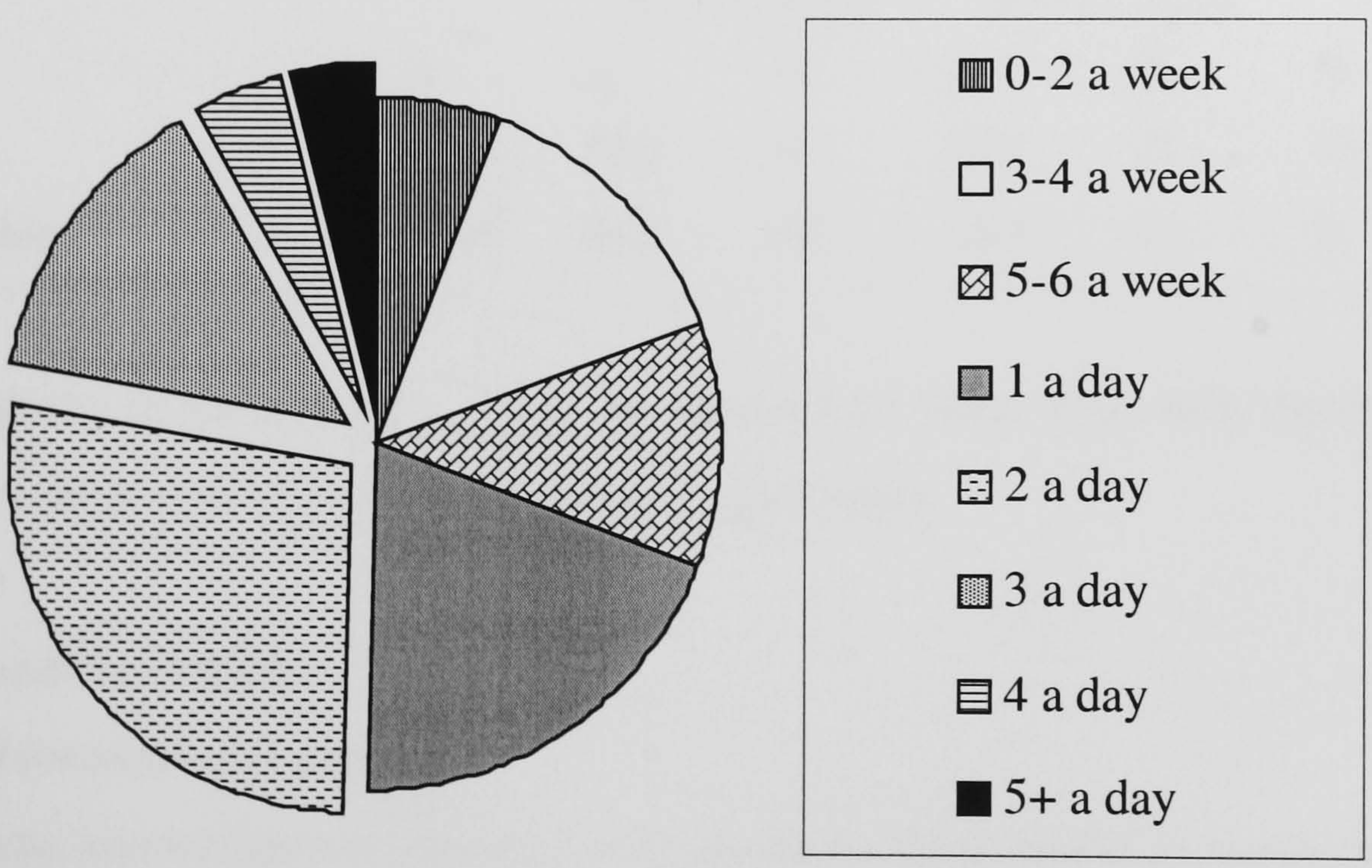


Figure 2 Distribution of vegetable servings



Less than half of the sample reported eating 2 or more servings of fruit a day or 2 or more servings of vegetables a day. When the data were combined to look at total daily servings of fruit and vegetables only 27% ate at least 5 servings a day, and only 22% ate the appropriate proportion of both fruit and vegetables (2-3 of each per day). The mean intake for fruit and vegetables was approximately 3.3 servings combined a day with a median of 3 (s.d. = 2.1). Participants who reported eating more servings of fruit tend to report eating more vegetables servings ($r_p = 0.44$, $p<0.001$).

Table 5 Combined daily serving of fruit and vegetables

<1 a day		1 a day		2 a day		3 a day		4 a day		5+ a day	
n	%	n	%	n	%	n	%	n	%	n	%
50	3	354	20	311	17	298	17	285	16	481	27

Participants were asked to rate the adequacy of their present consumption levels and the majority of participants perceived their intake as 'about right'. When actual intake levels were cross-tabulated with perceived adequacy of intake approximately 67% of people correctly rated their adequacy of fruit intake and 56% for vegetable intake. See Table 6 for perception of adequacy of intake.

Table 6 Perception of adequacy of intake for fruit and vegetables.

		Not enough		About right		Too much	
	n	n	%	n	%	N	%
Fruit	1736	838	48	883	51	15	1
Vegetables	1735	655	38	1071	62	9	0

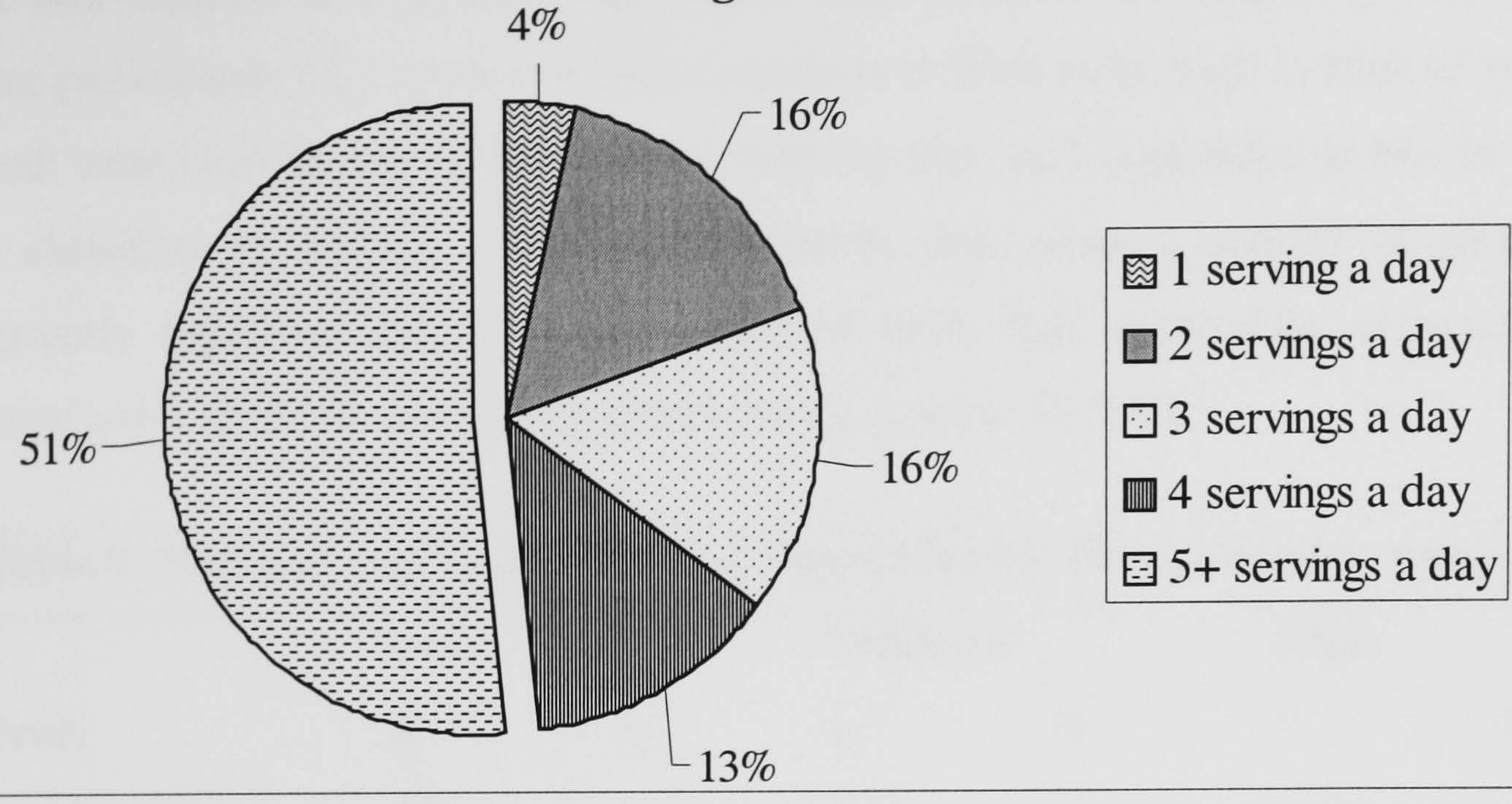
The majority of participants (78%), consumed fruit juice, with 44% drinking less than one glass daily and 34% drinking at least 1 glass daily.

Nutritional knowledge

Recommended servings

Nutritional knowledge was assessed with questions about health recommended servings, the relationship between diet and major health problems or disease, and the nutrient content of fruit and vegetables. The results show that only 51% (853) of the sample correctly estimated the number of recommended servings to be at least 5 servings of fruit and vegetables a day. The mean number of recommended servings were 4.2 a day (s.d. = 1.6). The frequency distribution is shown in Figure 3.

Figure 3 Estimated health recommended servings of fruit and vegetables



Diet and disease

Only 53% (870) of the sample felt that they had knowledge of a relationship between intake of fruit and vegetables and major health problems or diseases (5% of these not naming anything). However when questioned to name specific diseases or health problems only 12% of total participants named both heart disease and cancer, with a further 14% able to name one or the other. Some participants mentioned specific cancers such as colon or bowel cancer. Other diseases that were mentioned included scurvy and rickets. The breakdown of known diseases is displayed in Table 7.

Table 7 Health problems or diseases associated with low intake of fruit and vegetables

Health problems	n	% of total participants
Cancer alone	49	3
Heart disease alone	40	2
Specific cancers (bowel or colon)	69	4
Cancer and other problem (specified below)	41	2
Heart disease and other problem (specified below)	50	3
Cancer and heart disease	210	12
Scurvy	169	9
Rickets	20	1
Other (i.e. beri beri, vitamin deficiency, etc.)	118	12
Total number	**858**	**48**

Nutrient content

Nutrient content was measured by asking participants to estimate the levels of vitamins, fibre and calories in fruit and vegetables. See Table 9 for frequency distributions. Those participants who estimated either vitamins or fibre to be high in fruit or vegetable overall were classified as correct, whilst marking fruit and vegetables as low in calories was classified as correct. The results indicate that about a quarter of participants incorrectly estimated the vitamin content of fruit, half incorrectly estimated fibre content and a third incorrectly estimated calorie content for fruit.

Table 8 Nutrient content of fruit and vegetables for fibre, vitamins and calories

	Low		Medium		High	
Fruit	n	%	n	%	N	%
Vitamins	19	1	421	26	1190	73
Fibre	158	10	661	41	777	49
Calories	1022	66	474	30	58	4
Vegetables						
Vitamins	27	2	455	28	1150	70
Fibre	56	4	419	27	1082	69
Calories	1071	70	383	25	69	5

About a third of participants incorrectly rated vitamin, fibre and calories content each for vegetables. Approximately 65% of participants had heard about antioxidants.

An overall nutritional knowledge measure was calculated by combining binary scores (correct/incorrect) for recommended servings, nutrient content (vitamin, fibre, calorie content for fruit/vegetables), knowledge of antioxidants and diet/disease relationship. Using a 10 point scale (0-9) it was found that only 104 (6%) correctly identified all of the factors, with 478 (43%) in the upper third of scoring range.

Table 9 Overall Nutritional knowledge	**Low**	**Medium**	**High**
Nutritional knowledge (0-9)	0-3	4-6	7-9
	13%	44%	43%

Attitudes

Respondents were asked about their attitudes to factors relating to both fruit and vegetables. The response scale ranged from 1-4 (1 = strongly disagree – 4= strongly agree). The results of these are shown in Table 10 for fruit and Table 11 for vegetables.

Attitudes		Strongly disagree		Disagree		Agree		Strongly agree	
Fruit	**n**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Makes a convenient snack	**1747**	26	1	61	4	1060	61	600	34
Good quality can be bought locally	**1718**	43	3	209	12	1254	73	212	12
Takes a long time to prepare	**1692**	736	44	872	51	43	3	41	2
Is expensive	**1725**	66	4	861	50	679	39	119	7
Doesn't keep very well	**1706**	75	4	772	45	785	46	74	4
Is difficult to carry around	**1711**	296	17	1045	61	327	19	43	3
Taste delicious	**1733**	18	1	76	4	987	57	652	38
Is not filling	**1718**	125	7	966	56	583	34	44	3
Is good for weight control	**1708**	12	1	95	6	1237	72	364	21
Is healthy	**1727**	14	1	17	1	729	42	967	56
Is bad for you	**1647**	1154	70	495	28	14	1	14	1

Attitudes		Strongly disagree		Disagree		Agree		Strongly agree	
Vegetables	**n**	**n**	%	**n**	%	**n**	%	**n**	%
Make a convenient snack	**1729**	99	6	677	40	793	46	160	9
Good quality can be bought locally	**1761**	57	3	226	13	1244	71	234	13
Take a long time to prepare	**1726**	310	18	1123	65	246	14	47	3
Are expensive	**1741**	218	12	1089	63	342	20	92	5
Don't keep very well	**1742**	95	5	848	49	720	41	79	5
Are difficult to carry around	**1744**	190	11	1015	58	472	27	64	4
Taste delicious	**1754**	45	3	231	13	1031	59	447	25
Are not filling	**1733**	211	12	1044	60	427	25	51	3
Are good for weight control	**1729**	27	2	88	5	1229	71	385	22
Are healthy	**1765**	27	2	13	1	612	34	1113	63
Are bad for you	**1666**	1300	78	300	18	16	1	50	3

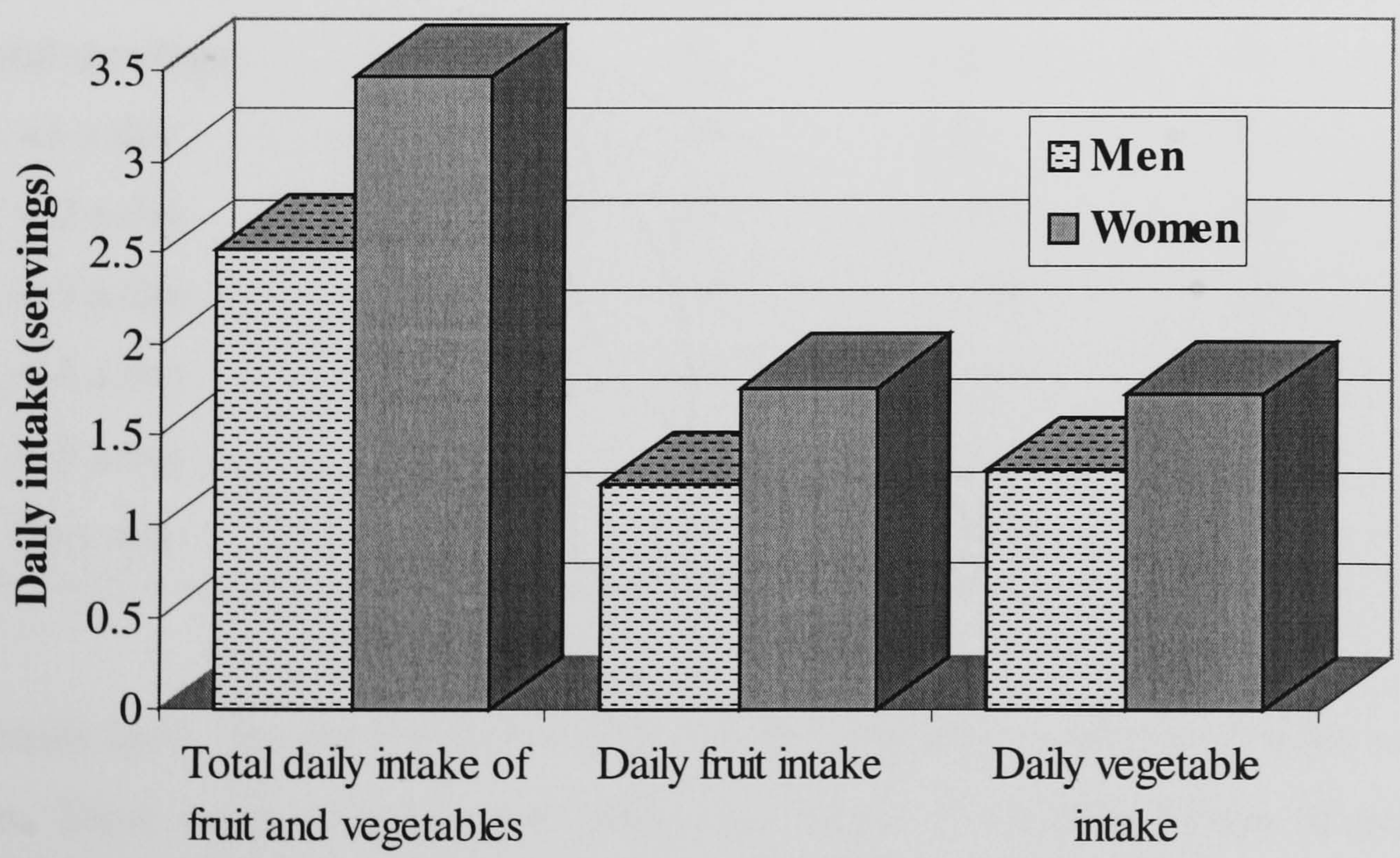
The data indicate that the majority of respondents had positive attitudes about preparation, availability and taste of fruit and vegetables. As well as this as expected almost all of participants felt that fruit and vegetables were healthy and were not bad for you. However almost half felt that fruit and a quarter felt that vegetables were expensive, whilst approximately half thought that fruit and vegetables don't keep very well. 37% also thought fruit and 28% thought vegetables were not filling. Other new attitudes examined showed that around a third of people felt fruit and vegetable were not filling or were difficult to carry around. Many respondents thought that vegetables did not make a convenient snack (46%).

Gender differences

Gender differences in intake

Women consumed significantly more fruit (t [df=1706] = -8.95, p< 0.001) and vegetables (t [df=1702] = -6.49, p< 0.001) than men as displayed in Figure 4. There was a significant difference in the combined total daily servings of fruit and vegetable with 2.72 (s.d.=1.9) servings for men versus 3.64 (s.d.=2.1) for women (t df[1690], p.40, p<0.001).

Figure 4 Daily intake of fruit and vegetables by gender



The frequency results show that the percentage of women eating at least 2 servings daily of fruit ($\chi 2$ df[1], 67.6, p<0.001) and at least 2 servings daily of vegetables ($\chi 2$ df[1]. 32.6, p<0.001) is greater than the percentage of men. 32% for men versus 53% for women for fruit and 41% for men and 56% for women for vegetables.

Table 12 Gender frequencies for fruit and vegetable servings								
	Men				Women			
	Fruit n=644		Vegetables n=644		Fruit n=1064		Vegetables n=1060	
Servings	n	%	n	%	n	%	n	%
0-2 per week	133	21	48	8	110	10	50	5
3-4 per week	96	15	104	16	139	13	120	11
5-6 per week	74	11	88	14	98	9	106	10
1 per day	133	21	138	21	157	15	195	18
2 per day	120	19	166	26	264	25	310	29
3 per day	55	8	65	10	167	16	175	17
4 per day	18	3	20	3	79	7	56	5
5+ per day	15	2	15	2	50	5	48	5

There was a significant differences in the spread of total daily intake levels for fruit and vegetables (χ^2 [df=7] = 76.73, p<0.001) with only 17% of men and 33% of women eating the recommended levels of 5 a day.

Table 13 Total daily servings of fruit and vegetables for men and women				
	Men n=638		Women n=1056	
Total servings	n	%	n	%
<1 a day	104	16	83	8
< 2 a day	163	25	192	18
< 3 a day	102	16	130	12
< 4 a day	82	13	145	14
< 5 a day	78	12	159	15
5+ a day	109	17	349	33

The results show that the frequency of perceived adequacy is very similar for men and women. There were no significant differences found in the distribution of perceived adequacy of intake for vegetables. (χ^2 = 0.35, df[2], ns) although more men rated their fruit intake lower than women (χ^2 = 5.09, df[2], p<0.05).

Table 14 Perception of adequacy of intake by gender								
	Men				**Women**			
	Fruit		**Vegetables**		**Fruit**		**Vegetables**	
	n	**%**	**n**	**%**	**N**	**%**	**n**	**%**
Not enough	327	52	238	38	472	46	386	38
About right	294	47	387	61.5	534	53	627	64.5
Too much	3	0.5	3	0.5	5	1	9	1

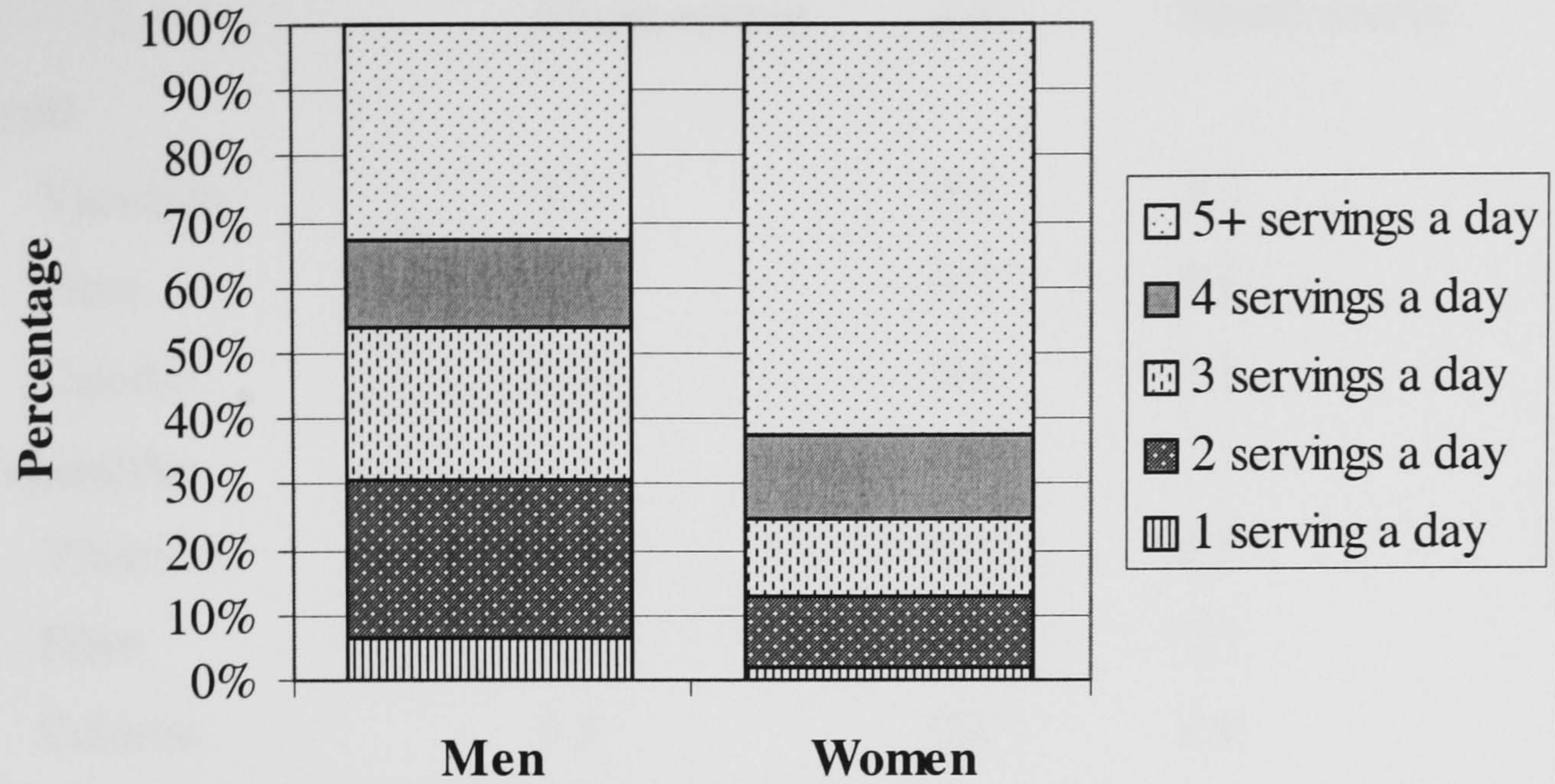
Looking at the number of women and men who correctly estimated their adequacy of intake, the results show that significantly more women correctly estimated fruit intake (χ^2 = 20.34, df[1], p<0.001) but significantly more men correctly rated vegetable intake ((χ^2 = 18.63, df[1], p<0.001) than men (see Table 15).

Table 15 Correct estimations of adequacy of intake by gender								
	Men				**Women**			
	Fruit		**Vegetables**		**Fruit**		**Vegetables**	
	n	**%**	**n**	**%**	**N**	**%**	**n**	**%**
Correct	399	64	446	70	718	70	619	61

Gender differences in nutritional knowledge

There was a significant difference in health recommended servings for fruit and vegetables (t [df=955], = -11.21, p<0.001). Women estimated the recommended servings of fruit and vegetable servings at 4.5 (s.d.=1.6), compared with 3.6 (s.d.=1.5) for men. The majority of women (63%) knew about health recommendations of 5+ servings a day for fruit and vegetables compared to only a third of men. (χ^2 = 116.32, df[1], p<0.001). See Figure 5 for distribution of health recommended servings.

Figure 5 Estimate health recommended servings for men and women



Significantly more women (57%) felt they were aware of a relationship between diet and disease than men (46%) ($\chi^2 = 18.79$, df[1], $p<0.001$). Also more women were able to name a specific disease (28% cancer, heart disease or both) than men (22%) ($\chi^2 = 20.2$, df[6], $p<0.01$) (see Table 16).

Table 16 Nutrition knowledge items by gender

	Men		Women	
	N	%	N	%
Knowledge of diseases	290	46	569	57
Knowledge of antioxidants	378	65	698	74
Knowledge of recommended servings	206	34	637	63

Significantly more women had heard of antioxidants (74%) than men (65%) ($\chi^2 = 14.55$, df[1], $p<0.001$).

There were significant differences in estimations about nutrient content with women estimating higher levels of fibre (t df[1587]=-2.36, $p<0.05$) and lower levels of calories (t df[1548]=3.70, $p<0.01$) in fruit. They also rated higher levels of vitamins (t df[1624]=-5.24, $p<0.01$) and lower levels of calories in vegetables (t df[1517]=5.47, $p<0.01$) than men.

Table 17 Estimated nutrient content for fruit and vegetables by gender				
1 = low – 3 = high	**Men**		**Women**	
	Mean scores	**s.d.**	**Mean scores**	**s.d.**
Fruit				
Vitamins	2.7	0.5	2.7	0.5
Fibre	2.3	0.7	2.4	0.6
Calories	1.4	0.6	1.3	0.5
Vegetables				
Vitamins	2.6	0.5	2.7	0.5
Fibre	2.6	0.5	2.7	0.5
Calories	1.5	0.6	1.8	0.5

There was also a significant difference in the overall nutritional knowledge of men and women. 49% of women had high levels (7-9) of nutritional knowledge compared to only 32% of men. (χ^2 [df=2], = 34.63, p<0.01). The nutritional knowledge measure took account of recommended servings, knowledge about diet and disease relationship. nutrient content and knowledge about antioxidants (see Table 18).

Table 18 Nutritional knowledge by gender				
Knowledge (0-9)	**Men**		**Women**	
Low	82	18	68	10
Medium	230	50	276	41
High	148	32	328	49

Gender differences in attitudes

There were also significant but small gender differences in a number of the different factors to fruit and vegetables. The mean scores for these are presented in Table 86. Women were more positive about the convenience (t [df=1682] = -5.14, p<0.015), taste (t [df=1669] = -4.45, p<0.01), 'filling' (t [df=1661] = 2.82, p<0.01), weight control value (t [df=16650] = -3.39, p<0.01) of fruit, and also more positive about the convenience (t [df=1650] = -6.15, p<0.01), preparation (t [df=1648] = 2.36, p<0.05), taste (t [df=1673] = -6.56, p<0.01), weight control value (t [df=1649] = -6.19, p<0.01), health value (t [df=1681] = -2.91, p<0.01), and 'badness' (t [df=1592] = 2.72, p<0.05) of vegetables.

Table 19 Attitude differences by gender

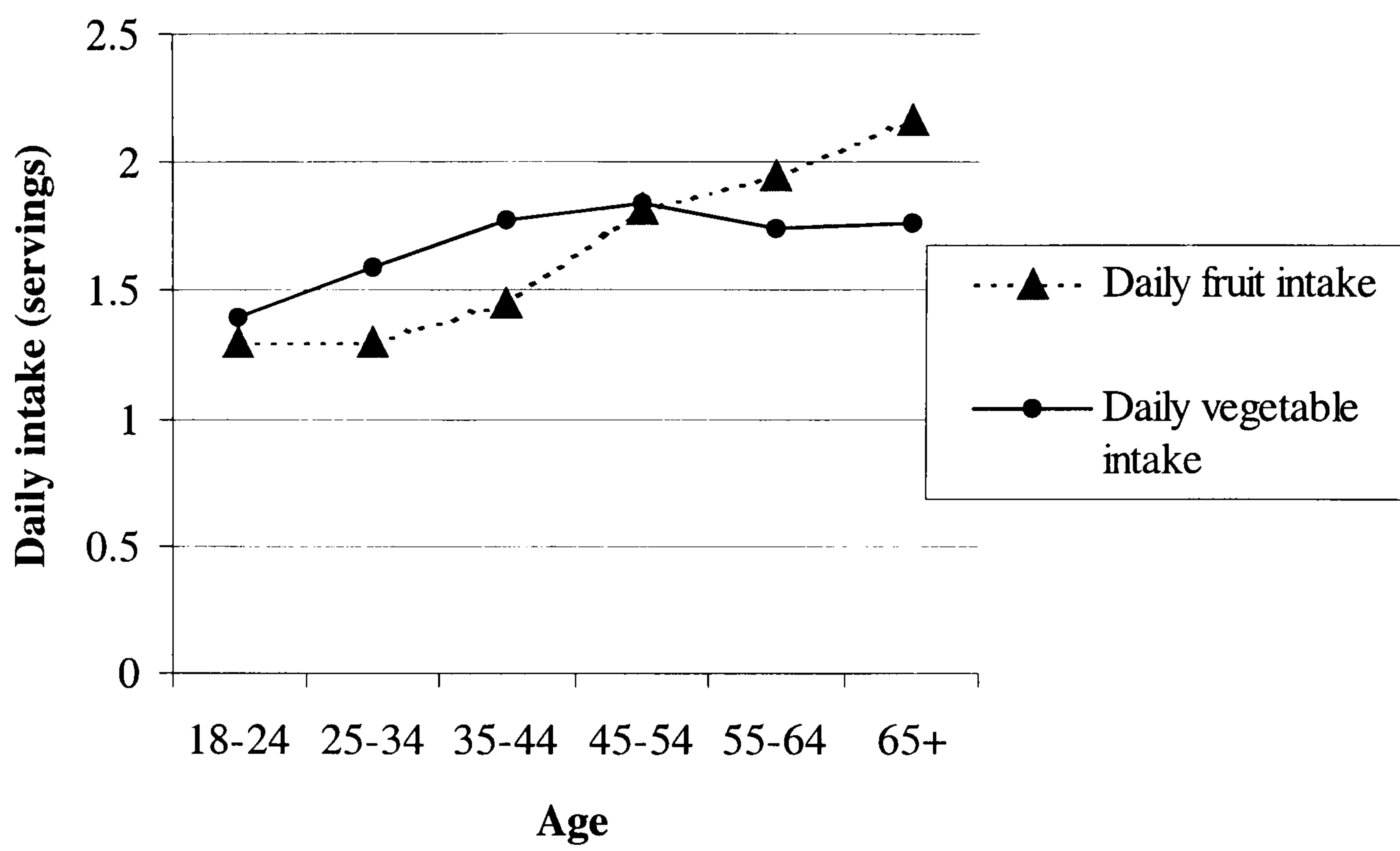
	Fruit				Vegetables			
	Men		Women		Men		Women	
Attitudes	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**
Convenience	3.19	0.61	3.35	0.57	2.45	0.74	2.68	0.72
Quality	2.97	0.54	2.95	0.61	2.95	0.59	2.94	0.63
Preparation	1.66	0.64	1.61	0.65	2.06	0.64	1.98	0.65
Price	2.45	0.68	2.52	0.68	2.15	0.73	2.17	0.68
Storage	2.52	0.65	2.50	0.65	2.48	0.66	2.43	0.66
Transportation	2.05	0.67	2.07	0.68	2.23	0.68	2.24	0.69
Taste	3.23	0.61	3.37	0.58	2.94	0.71	3.16	0.66
Filling	2.38	0.64	2.28	0.65	2.16	0.69	2.18	0.66
Good for weight control	3.09	0.49	3.18	0.54	3.04	0.53	3.21	0.55
Healthy	3.51	0.58	3.56	0.54	3.55	0.62	3.64	0.54
Bad for you	1.32	0.51	1.32	0.54	1.33	0.66	1.24	0.59

Age differences

Intake

There was a linear relationship between age and consumption of fruit (ANOVA df[5, 1686]=18.92, $p<0.001$) with younger adults eating fewer servings of fruit, whilst for vegetables participants in the 45-54 age range consumed the most servings of vegetables (ANOVA df[5, 1684]=3.59, $p<0.01$).

Figure 6 daily fruit and vegetable intake by age



Nutritional knowledge

Nutritional knowledge showed a similar pattern to vegetable intake, with a rise with age until the 45-54 age brackets and then a decline in later years (ANOVA df[5, 1120]=6.23, $p<0.001$) (see Table 20).

Table 20 Nutritional knowledge scores by age

	18-24	25-34	35-44	45-54	55-64	65+
Mean	5.52	5.87	5.99	6.23	5.71	4.92
s.d.	1.64	1.90	1.99	2.04	2.14	2.42

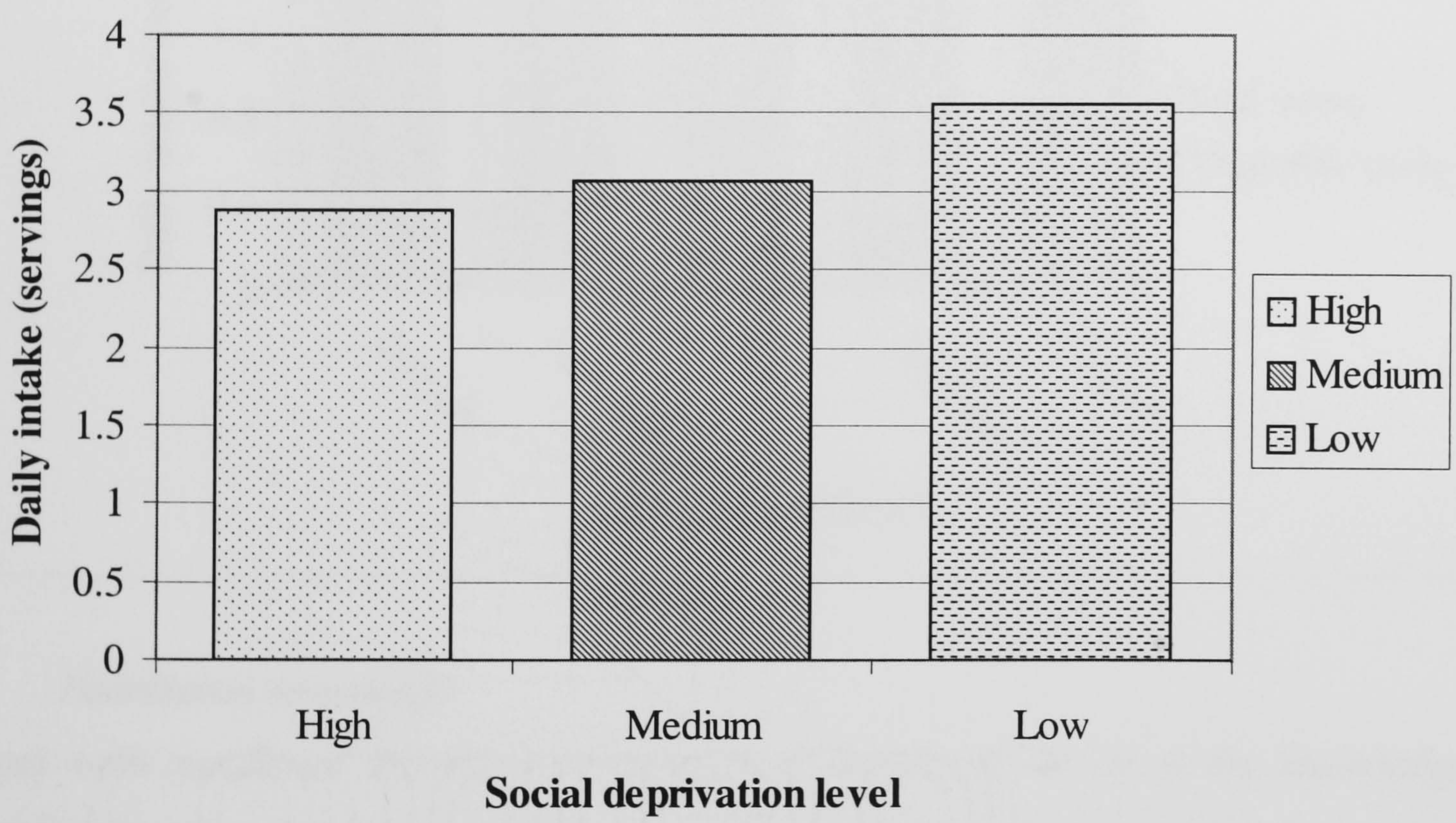
Socio-economic deprivation differences

An index of social-economic deprivation was constructed using car ownership and housing tenure. There were 267 (18%) with high rated levels deprivation (no car and not home owners), 387 (26%) with medium rated levels of deprivation and 836 (56%) with low rated levels of deprivation.

Fruit and vegetable intake

There was a significant difference in daily intake of fruit (Anova [df=2, 1469], F= 10.48, p<0.001) and vegetables (Anova [df=2, 1464], F= 11.40, p<0.001) by social deprivation level as illustrated in Figure 7. Participants with the highest levels of deprivation consumed fewer servings combined of fruit and vegetables and those with lowest levels of deprivation consumed more servings of fruit and vegetables.

Figure 7 Daily fruit and vegetable intake by deprivation level



Nutritional knowledge

There were marginal differences in overall nutritional knowledge scores (Anova [2, 1028], F=3.07, p=0.05) although these were not conclusive. Participants with the lowest deprivation levels, had the highest overall knowledge scores (6.01), compared with 5.70 in mid deprivation and 5.73 in high deprivation.

Attitudes

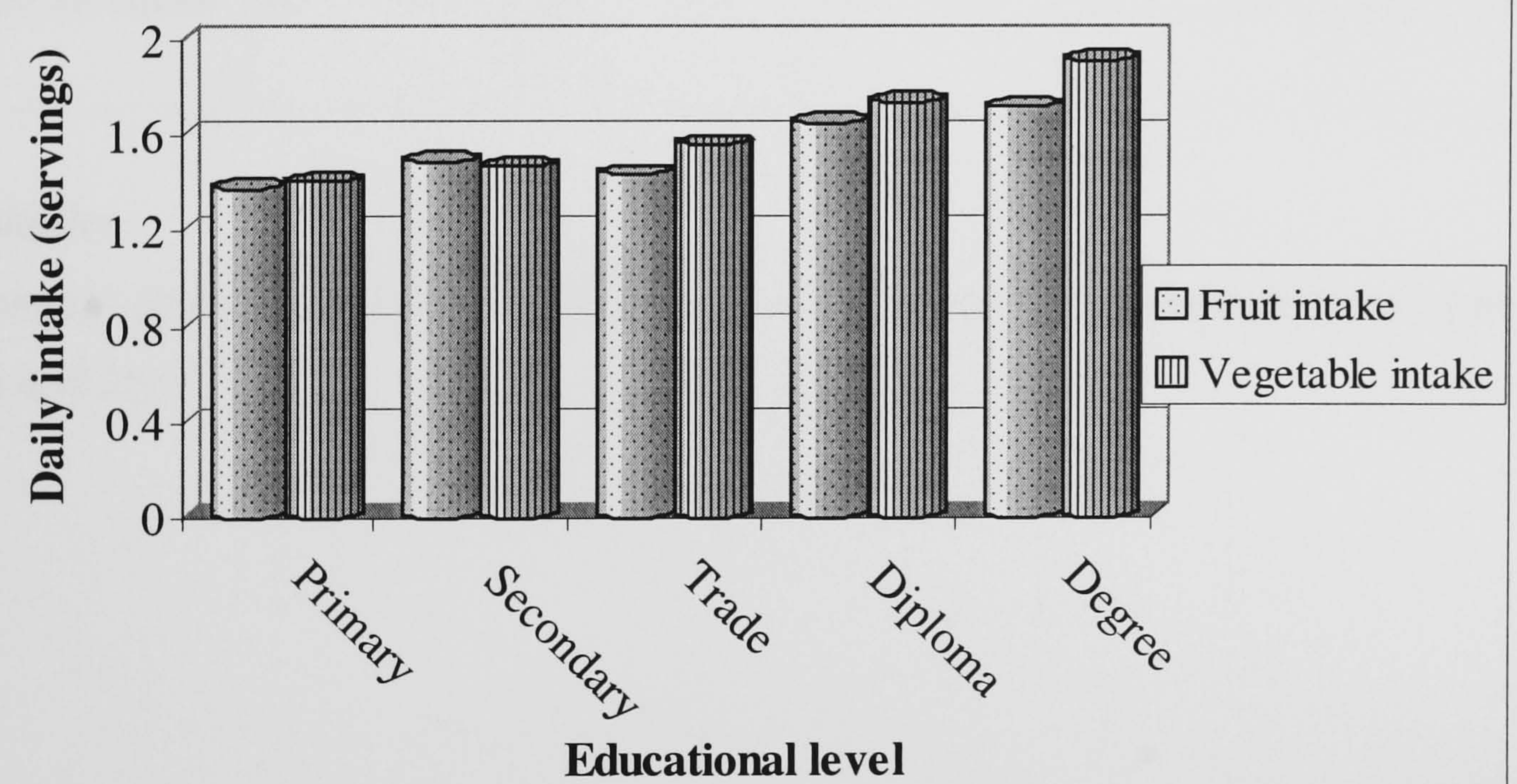
There were no significant differences by social deprivation on the key attitude factors such as price.

Education differences

Intake

There were significant differences in total daily intake of fruit (Anova [df=4, 1662], F= 3.55, p<0.001) and vegetables (Anova [df=4, 1658], F= 11.72, p<0.001), by educational levels. See Figure 20. Participants who had the lowest educational levels consumed fewer servings of fruit and vegetables than participants in other education levels groups.

Figure 8 Fruit and vegetable intake by highest educational level



Nutritional knowledge

There were significant differences in nutritional knowledge on all of the knowledge measures by educational level. Participants with the highest educational level estimated recommended servings closest to actual recommendations of 5 a day (Anova df[4, 1603], F=5.62, p<0.001). See Table 22.

Table 22 Estimated recommended servings by highest education level

	Primary	Secondary	Trade	Diploma	Degree
Recommended servings	3.03	4.09	3.90	4.20	4.27

The majority of participants with further education had heard of antioxidants with the majority of those with a diploma or degree knowing of diseases related to fruit and vegetable consumption.

Table 23 Knowledge factors by highest educational level

	Primary		Secondary		Trade		Diploma		Degree	
	n	%	n	%	n	%	N	%	n	%
Correctly estimating recommended servings	8	28	218	48	80	44	99	50	426	57
Knowledge of antioxidants	11	39	242	58	116	67	130	70	558	80
Knowledge of disease	9	29	170	38	58	33	107	56	503	67
Knowledge of all three	4	17	88	23	27	17	51	30	262	39

Attitudes

There were no obvious patterns in differences of attitudes by educational level (see Tables 24 and 25).

Table 24 Attitudes to fruit by educational level

Attitudes	**Primary**	**Secondary**	**Trade**	**Diploma**	**Degree**
Fruit					
Convenience	3.13	3.20	3.20	3.35	3.35
Quality	2.89	2.95	2.98	3.00	2.95
Preparation	3.11	3.28	3.32	3.36	3.46
Price	2.37	2.47	2.49	2.47	2.54
Storage	2.57	2.50	2.41	2.52	2.51
Transportation	3.00	2.90	2.89	2.93	2.97
Taste	3.31	3.26	3.21	3.35	3.37
Filling	2.38	2.61	2.68	2.76	2.72
Good for weight control	2.96	3.15	3.10	3.26	3.15
Healthy	3.47	3.46	3.42	3.61	3.60
Bad for you	3.48	3.57	3.60	3.72	3.77

Table 25 Attitudes to vegetables by educational level

Attitudes	Primary	Secondary	Trade	Diploma	Degree
Vegetables					
Convenience	2.48	2.52	2.63	2.67	2.60
Quality	2.91	2.95	2.98	2.98	2.93
Preparation	2.80	2.97	2.98	3.04	3.01
Price	2.72	2.79	2.73	2.80	2.91
Storage	2.57	2.54	2.53	2.55	2.56
Transportation	2.79	2.76	2.68	2.80	2.78
Taste	2.84	2.92	3.07	3.15	3.17
Filling	2.62	2.73	2.80	2.86	2.88
Good for weight control	3.00	3.12	3.11	3.20	3.18
Healthy	3.30	3.53	3.51	3.65	3.67
Bad for you	3.33	3.68	3.65	3.70	3.79

240

Smoker/non smoker differences

Using self-rated smoking status as a marker of smoking, differences in behavioural and psychological measures were assessed. There were 444 (28%) of people who said they smoked. Smokers tended to have lower educational levels (χ^2 = 20.60, df[4], p<0.01) and also had higher levels of social deprivation (χ^2 = 58.51, df[2], p<0.01). Therefore educational level and socio-economic deprivation have been included as covariates so that conclusions drawn take account of possible confounding variables. Smokers consumed fewer servings of fruit (ANCOVA df[1, 1370]=49.80, p<0.001) and vegetables (ANCOVA df[1, 1366]=11.08, p<0.01) than non-smokers even when educational levels and socio-economic deprivation were added as covariates.

Table 26 Intake and psychological factors by smoking status

	Smoker		Non Smoker	
	Mean	**s.d.**	**Mean**	**s.d.**
Fruit and vegetable intake	(adjusted means by education and deprivation levels)			
Daily fruit intake	1.19 (1.21)	1.2	1.76 (1.75)	1.3
Daily vegetable intake	1.50 (1.52)	1.2	1.77 (1.75)	1.2
Nutritional knowledge	5.58 (5.63)	2.0	5.97 (5.92)	2.1

Smokers also had lower levels of overall nutritional knowledge than non smokers using the same covariates (Ancova df[1,975], =4.31, p<0.05) .

Diet status differences

There were significant differences in intake levels for fruit and vegetables dependent on whether participants were on a diet or not. Participants on a diet consumed significantly more servings of fruit (t=-4.96, df[1443], p<0.001) and significantly more servings of vegetables (t=-6.69, df[1446], p<0.001). Dieters also had higher levels of nutritional knowledge (t=-3.55, df[1015], p<0.001) (see Table 27).

Table 27 Intake and knowledge by diet status			
	Fruit intake	**Vegetable intake**	**Nutritional knowledge**
Diet			
Yes	1.96	2.17	6.30
No	1.53	1.60	5.74
Type of diet			
Vegetarian	1.98	2.53	6.46
Weight loss	1.85	1.79	6.29
Low fat	2.22	2.09	6.59
Diabetic	2.08	1.87	4.20
Other	2.07	2.31	6.72

Looking at the type of diet participants used, we found that there were no differences in fruit intake (Anova df[4,325] $F= 0.47$, p ns) but there were significant differences in vegetable intake (Anova df[4,324], $F=4.09$, $p<0.01$). Vegetarians consumed the largest amount of vegetables. Participants in the other diet category (e.g. Hay Diet, Gluten Free etc.) had the highest levels of nutritional knowledge (Anova df[4,216], $F=3.55$, $p<0.01$).

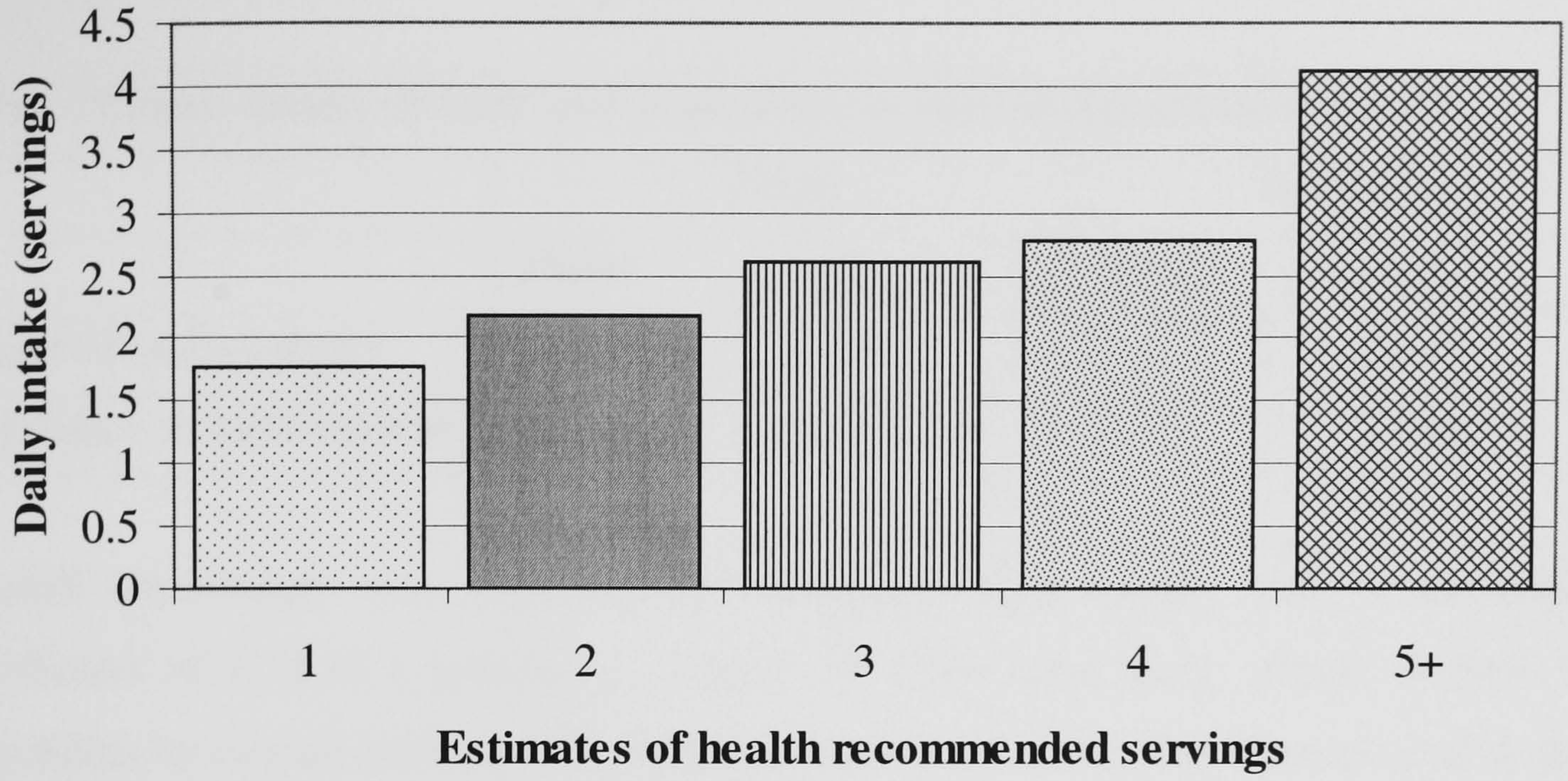
Predictors of fruit and vegetable intake

Nutritional knowledge

Recommended servings

Recommended servings of fruit and vegetables correlated highly with actual intake ($r_p =0.37$ $p<0.001$). See Figure 9. There was a clear linear relationship between the participants believe health experts recommend and the total daily intake of fruit and vegetables.

Figure 9 Daily intake of fruit and vegetables by health recommended servings



Diet and disease

There were also significant differences in mean intake for those who were aware of a relationship between diet and disease and those who were not ($t\ [df=1775] = 9.92$, $p< 0.001$). Participants who were aware of a relationship consumed 3.80 (s.d. 2.0) servings compared to 2.83 (s.d. 2.1) for those who were no aware.

Nutrient content

The estimated nutrient content for vitamins, fibre and calories of fruit and vegetables was significantly correlated with intake. This indicates that those people who believe that fruit and vegetables are high in important nutrients such as vitamins and fibre eat more of them, and those who perceive that they are low in calories also eat more fruit and vegetables. See Table 28

Table 28 Correlation between estimated nutrient content and intake

	Fruit		**Vegetables**	
	r_s	p<	r_s	p<
Vitamins	.06	.05	.11	.001
Fibre	.12	.001	.10	.001
Calories	-.06	.05	-.08	.01

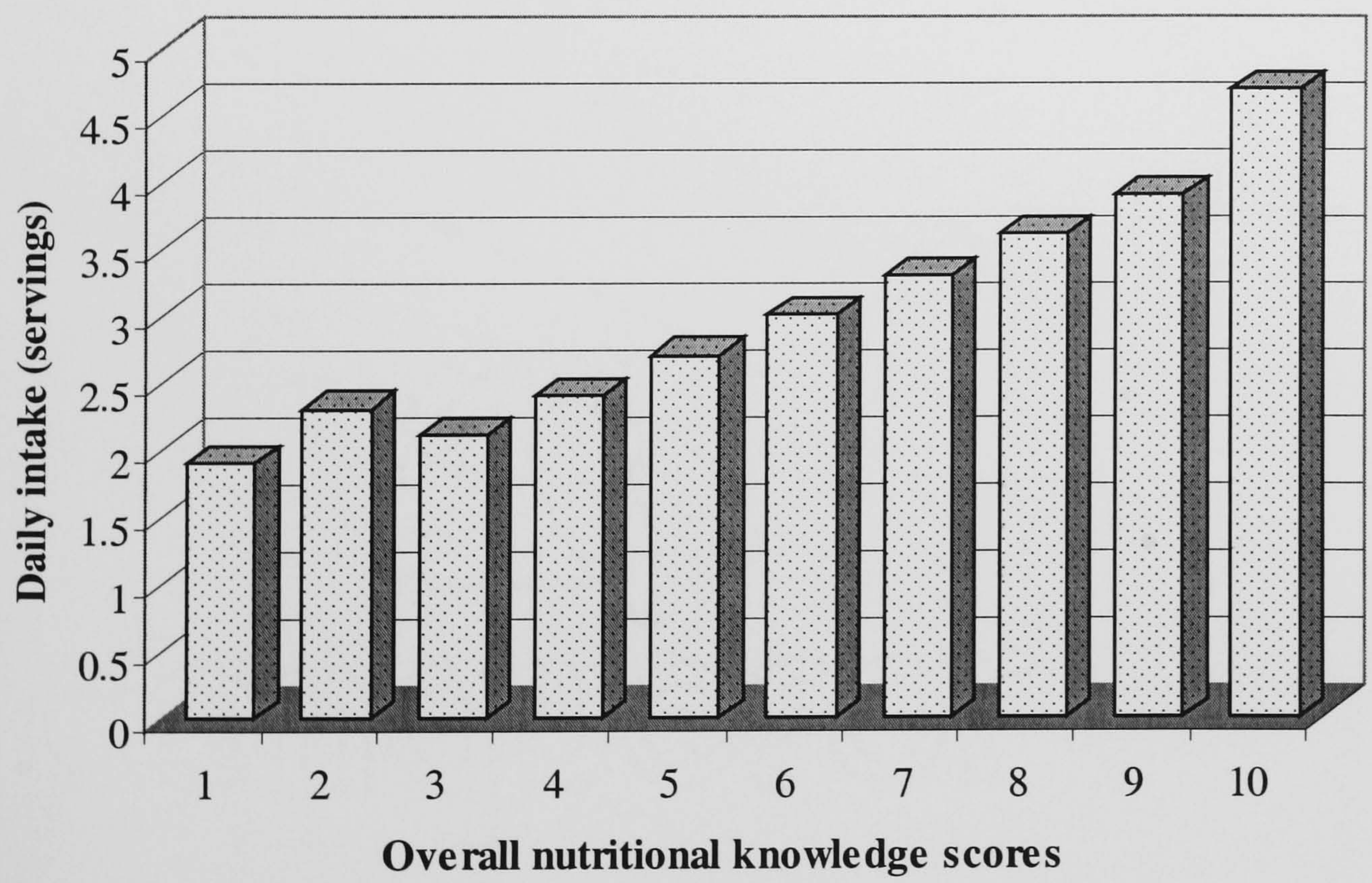
It was also found that participants who had heard of antioxidants consumed more fruit (Anova df[1,1525], F=49.38, $p<0.01$) and vegetables (Anova df[1,1522], F=73.51, $p<0.01$) than those who had not (see Table 29).

Table 29 Daily intake of fruit and vegetables by knowledge of antioxidants

	Fruit		Vegetables	
	Mean	**s.d.**	**Mean**	**s.d.**
Heard of antioxidants	1.74	1.27	1.87	1.19
Not heard of antioxidants	1.25	1.23	1.31	1.06

Overall knowledge was significantly correlated with intake with a correlation coefficient of r_s 0.34 ($p<0.001$). Figure 10 show total daily intake of fruit and vegetables by overall nutritional knowledge (scale 0-10) indicating a linear relationship.

Figure 10 Daily intake of fruit and vegetables by overall nutritional knowledge



Attitudes

Factor analysis was conducted to look at the factorial structure of the attitudinal factors and also to confirm the two factors highlighted in the previous study. Initially factor analysis was conducted using the whole of the dental group on attitudes to fruit and vegetables. There was no obvious pattern of factors that emerged, thus analysis was conducted only on participants aged 55-65 years. When only participants of comparable age with the flexiscope sample were included in the analysis, the same two factors emerged for vegetable intake (positive and negative) with the attitude aspects entered. However although 2 factors emerged for fruit, these included different aspects than previously. Further analysis showed that there were a number of different factors, which differentiated fruit and vegetables. This indicates that there was no overall pattern of attitudes for fruit or vegetables that could be distinguished in this sample. As no obvious constructs were highlighted, analysis has been conducted with individual variables only. Table 30 shows the correlations matrix for attitudes.

Table 30 Fruit attitudinal factors correlation matrix (p values ↓,correlation coefficients →)

Fruit	Bad for you	Carry	Filling	Quality	Healthy	Storage	Preparation	Price	Snack	Taste	Weight
Bad for you		0.183	0.064	0.093	0.566	0.051	0.340	0.003	0.325	0.284	0.284
Carry	0.000		0.157	0.141	0.171	0.215	0.362	0.185	0.194	0.190	0.130
Filling	0.010	0.000		0.104	0.090	0.237	0.116	0.121	0.217	0.187	0.082
Quality	0.000	0.000	0.000		0.078	0.107	0.149	0.175	0.185	0.178	0.260
Healthy	0.000	0.000	0.000	0.001		0.026	0.270	-0.009	0.374	0.399	0.349
Storage	0.039	0.000	0.000	0.000	*0.280*		0.083	0.303	0.075	0.084	0.009
Preparation	0.000	0.000	0.000	0.000	0.000	0.001		0.062	0.326	0.301	0.218
Price	*0.893*	0.000	0.000	0.000	*0.695*	0.000	0.011		-0.006	-0.025	0.020
Snack	0.000	0.000	0.000	0.000	0.000	0.002	0.000	*0.790*		0.639	0.301
Taste	0.000	0.000	0.000	0.000	0.000	0.001	0.000	*0.298*	0.000		0.293
Weigh	0.000	0.000	0.001	0.000	0.000	*0.711*	0.000	*0.413*	0.000	0.000	

Vegetables attitudinal factors correlations matrix (p values ↓,correlation coefficients →)

Vegetables	Bad for you	Carry	Filling	Quality	Healthy	Storage	Preparation	Price	Snack	Taste	Weight
Bad for you		0.071	0.141	0.087	0.450	0.037	0.162	0.123	0.036	0.180	0.189
Carry	0.004		0.113	0.131	0.067	0.173	0.383	0.145	0.104	0.133	0.027
Filling	0.000	0.000		0.096	0.076	0.244	0.161	0.148	0.122	0.236	0.036
Quality	0.000	0.000	0.000		0.138	0.070	0.122	0.148	0.082	0.140	0.203
Healthy	0.000	0.006	0.002	0.000		-0.005	0.108	0.055	0.056	0.236	0.312
Storage	*0.137*	0.000	0.000	0.004	*0.852*		0.188	0.261	0.091	0.104	-0.011
Preparation	0.000	0.000	0.000	0.000	0.000	0.000		0.115	0.221	0.235	0.119
Price	0.000	0.000	0.000	0.000	0.024	0.000	0.000		-0.032	-0.006	0.045
Snack	*0.152*	0.000	0.000	0.001	0.022	0.000	0.000	*0.188*		0.347	0.152
Taste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.789*	0.000		0.186
Weigh	0.000	*0.261*	*0.143*	0.000	0.000	*0.643*	0.000	*0.063*	0.000	0.000	

Using a Spearman's correlation to look at the association between different attitudes and behaviour revealed significant correlations between attitudes to fruit and vegetables and intake. The only attitude which was not significantly correlated with intake is the price of fruit. This will be discussed further in the discussion section. This would suggest that attitudes are associated with behaviour, although they could mediate or be mediated by other psychological factors. See Table 31.

Table 31 Correlation matrix for attitudinal factors and fruit and vegetable intake

	Fruit		**Vegetables**	
Attitudes	r_s	p<	r_s	p<
Snack	0.27	0.001	0.23	0.001
Taste	0.29	0.001	0.36	0.001
Price	-0.05	0.05	-0.01	ns
Storage	-0.13	0.001	-0.13	0.001
Filling	-0.20	0.001	-0.14	0.001
Quality	0.07	0.01	0.06	0.05
Weight control	0.09	0.001	0.15	0.001
Badness	-0.09	0.001	-0.16	0.001
Healthiness	0.11	0.001	0.15	0.001
Preparation	-0.08	0.01	-0.12	0.001
Transportation	-0.05	0.05	-0.05	0.05

Multivariate analysis

Predictors of intake

Multivariate analysis was conducted to look at the independent predictors of fruit intake, and also possible mediation effects of psychological variables on demographic variation. Multiple regressions included demographic characteristics, nutritional knowledge and attitudinal factors as dependent variables. Independent effects of the three blocks of variables are shown in Table 32. Demographics characteristics account for 14%, nutritional knowledge accounts for 12% and attitudinal factors account for 12% of the variance in intake of fruit independently. Of the attitudinal factors 'fruit is filling', ease of storage, convenience as a snack and taste were the only significant predictors.

Table 32 Demographic characteristics, nutritional knowledge and attitudes as independent predictors of fruit intake (as 3 separate analysis)

	Beta	p<
Demographics		
Adjusted R Square = 0.14		
Age	0.21	0.001
Gender	0.19	0.001
Economic deprivation	0.03	Ns
Qualification	0.14	0.001
Smoking status	-0.15	0.001
Diet status	0.08	0.05
Nutritional knowledge		
Adjusted R Square = 0.12		
Recommended servings	0.27	0.001
Antioxidants	0.10	0.001
Diet disease link	0.09	0.001
Attitudes		
Adjusted R Square = 0.15		
Goodness	-0.04	Ns
Transportation	-0.03	Ns
Filling	0.09	0.001
Quality	0.01	Ns
Healthy	-0.00	Ns
Storage	0.10	0.001
Preparation	-0.02	Ns
Price	0.03	Ns
Convenience	0.11	0.001
Taste	0.22	0.001
Weight control	-0.01	Ns

A hierarchical regression was conducted in three stages to look at the impact of demographic factors, knowledge and attitudes on intake of fruit and vegetables consecutively. This was conducted to assess the mediation through knowledge and attitudes on demographic characteristics. Gender, highest qualification level, economic deprivation, age smoking status and diet status accounted for 14% (Adjusted R Square 0.14) of the variance in fruit intake, all having an independent effect apart from economic deprivation level. When nutritional knowledge factors of recommended servings, knowledge about diseases and knowledge of antioxidants were added to the equation a further 8% of variance was explained (Adjusted R Square 0.22). Knowledge factors appeared to mediate the qualification and diet status variations in intake marginally (see Table 33).

Finally when individual attitudinal factors related to fruit were added, this accounted for an additional 9% of the variance with 31% of the variance overall now being explained (Adjusted R Square 0.31). Attitudinal factors about 'fruit being filling, ease of storage, ease of preparation, perceived price and taste were the only significant predictors. Attitude factors might mediate some diet status and knowledge variation in fruit intake (see Table 33).

Table 33 Demographic, knowledge and attitude factors as predictors of fruit intake

Variable Df [20, 924] Adjusted R Square = 0.31	Demographic alone Beta value	Demographic + knowledge Beta value	Demographic + knowledge + attitudes Beta value
Demographics			
Age	0.21***	0.20***	0.21***
Gender	0.19***	0.12***	0.09**
Economic deprivation	0.03	0.02	0.03
Qualification	0.14***	0.09**	0.07*
Smoking status	-0.15***	-0.13***	-0.11***
Diet status	0.08**	0.06*	0.06*
Nutritional knowledge			
Recommended servings		0.24***	0.23***
Antioxidants		0.08**	0.07*
Diet disease link		0.10**	0.07**
Attitudinal factors			
Goodness			-0.04
Transportation			0.01
Filling			0.06*
Quality			0.01
Healthy			0.02
Storage			0.10**
Preparation			-0.06*
Price			0.08**
Convenience			0.05
Taste			0.22***
Weight control			-0.02

p<0.001 ***, p< 0.01 **, p<0.05 *

In the final model gender, age, highest qualification, smoking status, nutritional knowledge and attitudes are all independent predictors of fruit intake.

The same analysis was conducted for intake of vegetables. Independent effects of the three blocks of variables can be seen in Table 34. Demographic characteristics accounting for 8%, nutritional knowledge accounting for 12% and attitudinal factors accounting for 15% of the variance. Of the attitudinal factors perceived ease of storage, convenience of vegetables as a snack, taste and 'good for weight control' were significant predictors.

Table 34 Demographic characteristics, nutritional knowledge and attitudes as independent predictors of vegetable intake (as 3 separate analysis)		
	Beta	**p<**
Demographics		
Adjusted R Square = 0.8		
Age	0.08	0.05
Gender	0.12	0.001
Economic deprivation	0.07	0.05
Qualification	0.15	0.001
Smoking status	-0.06	Ns
Diet status	0.17	0.001
Nutritional knowledge		
Adjusted R Square = 0.12		
Recommended servings	0.26	0.001
Antioxidants	0.07	0.01
Diet disease link	0.14	0.001
Attitudes		
Adjusted R Square = 0.12		
Goodness	0.02	Ns
Transportation	-0.02	Ns
Filling	0.02	Ns
Quality	-0.01	Ns
Healthy	0.04	Ns
Storage	0.07	0.05
Preparation	0.02	Ns
Price	-0.02	Ns
Convenience	0.10	0.001
Taste	0.29	0.001
Weight control	0.07	0.01

As before, a hierarchical regression was conducted in three stages to look at the impact of demographic factors, knowledge and attitudes on intake vegetables. Gender, highest qualification level, economic deprivation, age smoking status and diet status accounted for 8% (Adjusted R Square 0.08) of the variance in fruit intake, all having an independent effect apart from smoking status. When nutritional knowledge factors of recommended servings, knowledge about diseases and knowledge of antioxidants were added to the equation a further 10% of variance was explained (Adjusted R Square 0.18). Knowledge factors mediated the effect of gender and socio-economic deprivation level with these becoming non significant in the model (see Table 35).

Finally when individual attitudinal factors related to vegetables were added, this accounted for an additional 9% of the variance with 27% of the variance overall now being explained (Adjusted R Square 0.27). Only the perceived taste of vegetables and convenience of vegetables as a snack were significant. These attitudinal factors led to a reduction in the variance explained by knowledge about diseases and antioxidants, as well as age (see Table 35).

Table 35 Demographic and nutritional knowledge as predictors of vegetables intake			
Variable **Df [10, 797]** **Adjusted R Square = 0.27**	**Demographic alone** **Beta value**	**Demographic + knowledge** **Beta value**	**Demographic + knowledge + attitudes** **Beta value**
Demographics			
Age	0.08*	0.08*	0.06*
Gender	0.12**	0.04	-0.02
Economic deprivation	0.07*	0.05	0.06*
Qualification	0.15***	0.11***	0.07*
Smoking status	-0.06	-0.04	-0.03
Diet status	0.17***	0.16***	0.13***
Nutritional knowledge			
Recommended servings		0.28***	0.28***
Antioxidants		0.07*	0.03
Diet disease link		0.08*	0.05
Attitudinal factors			
Goodness			0.01
Transportation			-0.03
Filling			0.00
Quality			0.03
Healthy			-0.00
Storage			0.04
Preparation			0.05
Price			-0.01
Convenience			0.08*
Taste			0.25***
Weight control			0.04
$p<0.001$ ***, $p< 0.01$ **, $p<0.05$ *			

Highest qualification, age and socio-economic deprivation level, nutritional knowledge and attitudes were all independent predictors of vegetable intake when added to a combined model. Different factors seem to mediate demographic factors for fruit and vegetables.

Summary of results

The results support previous finding which suggest clear demographic differences on a variety of behavioural and psychological factors. The differences between men and women, demonstrate that women consume more fruit and vegetables, possess higher levels of nutritional knowledge and have more positive attitudes to fruit and vegetables. Other demographic characteristics such as social deprivation and education indicate that participants with more deprivation markers (e.g. not car or home owners) consume fewer servings of fruit and vegetables and have lower levels of nutritional knowledge. Lastly other characteristics such as smoking behaviour and dietary behaviour also show differences. Non smokers and those participants on a diet were shown to consume more fruit and vegetables, with vegetarians consuming more servings of vegetables. Demographic characteristics, nutrition knowledge and attitudes all independently predict intake of fruit and vegetables, although psychological variable mediate the affect of demographic characteristics.

Discussion

Previous chapters show that cognitions were associated with behaviour. In particular, knowledge about diet and attitudes towards food were both independent predictors of fruit and vegetable intake. The associations with knowledge were especially strong. It was also clear that changing cognitions resulted in behaviour change in people attending for cancer screening. This chapter examines whether some of these associations can be replicated in a more representative sample taking account of some of the methodological issues raised earlier. Extending the work carried out earlier, this study aims to see whether knowledge and attitudes have independent effects on behaviour, or whether attitudes mediate the effect of knowledge.

In this study participants were selected from dental clinics around London, so that sample characteristics with regards to their interest in health and demographic makeup were defined by the setting. The types of people who attend for dental treatment tend to be more educated, with fewer coming from manual socio-economic classes (ONS, 2000). Stratified sampling was used to select different geographic areas to compensate for this, with certain clinics selected in areas with higher deprivation (e.g. Lambeth). However, it was evident from the data that the sample was more educated than average. Social deprivation indicators of home ownership and car ownership suggested a greater spread in deprivation level, but it is not uncommon for professional people to be neither home or car owners which may be characteristic of London as a city (e.g. house prices and transport issues). Nevertheless the sample size used in this study was sufficiently large and varied to draw conclusions about a number of demographic differences in the results, and it was different from the sample used in the first study.

Participants in this study were found to consume approximately 3.3 servings of fruit and vegetables a day which is 34% less than recommended level, with only 27% of the sample eating the recommended level of a least 5 servings a day. This is higher than some of the studies already mentioned (MAFF, 1994), although very comparable to a study conducted in GP practices in England (Wardle et al, 2000) which found intake of fruit and vegetables to also be 3.3 servings a day. The recently published National Food Survey (MAFF, 1999) found that participants in London consumed approximately 26% more fresh vegetables and 18% more fruit than the English average. Thus dietary objectives recommended by the WHO (1990) seem to be far off in being achieved, despite an increase in attention to raising fruit and vegetable intake levels.

Men consumed fewer servings of fruit and vegetables than women which is consistent with other investigations. There were also differences in intake in relation to a variety of other demographic and lifestyle factors measured. In this study participants were additionally asked about their age and other lifestyle factors such as smoking and diet history which may possibly be associated with dietary behaviour. Participants with lower SES and lower educational level consumed less fruit and vegetables as expected. Self-reported smokers consumed fewer servings of fruit and vegetables than non-smokers which has also been found before (Morabia and Wynder (1990); Whichelow, Erzinclioglu and Cox, 1991). This could be a result of different attitudes and knowledge but may also be due to a clustering of unhealthy lifestyles with smoking, or to different eating patterns and food preferences. As well as fewer servings of fruit and vegetables, smokers have been found to drink more alcohol and consume more fat. The differences exist even when socio-economic status is taken into consideration. This has important implications for the development of both cancer and heart disease, since if certain groups of people are more likely to have a number of risk factors, they therefore may be in greater need of interventions. These types of people need to be targeted before they are identified in hospital as a result of other health problems.

Participants who classified themselves as on a 'diet' (20%) consumed more servings of fruit and vegetables. The types of diet mentioned most commonly were weight loss, low fat, diabetic and vegetarianism. It may be that 'dieters' unlike 'smokers' are more concerned about their health overall but also eating fruit and vegetables is recommended for these types of diet. There were no differences in fruit intake between the different types of dieters although vegetarians consumed more vegetables. Several studies (Beilin and Burke, 1995 and Neumark-Sztainer, Story, Reskick and Blum, 1997) have also found that vegetarian diets are characterised by greater levels of fruit and vegetable intake, although the characteristics of 'other' diets has not been looked at.

There were differences in intake level by age, with participants who were older tending to eat more fruit and vegetables. Although there was a rise in vegetable intake with age, it declined from around 55 years of age. Nevertheless younger people (18-25 years) are consuming fewer servings of fruit and vegetables which may be a consequence of their lifestyle. One possible reason for this lower levels of intake in younger people is that younger people tend to eat more meals outside the home. The age group 15 to 34 years spends more on eating out than other groups (MAFF, 2000), with 25-34 year olds spending twice as much as average. Meals eaten in restaurants are commonly found to have lower nutrient content. It is therefore important to encourage younger people to eat more fruit and vegetables as the reduction in risk of cancer and heart disease is probably dependent on greater consumption from earlier on.

It is clear that fruit and vegetable intake is dependent on many different factors but demographic and lifestyle factors contribute to the diversity. Some of the demographic group differences highlighted here indicate that public health intervention would be wise to focus on these groups especially. The first study indicated that the differences in intake levels by gender, education and SES were partly as a consequence of poorer nutritional knowledge. Therefore it is likely that in this sample differentiated from the first by age and health motivation the same patterns exist. Overall the results reveal that participants from London are consuming inadequate servings of fruit and vegetables.

Previous results in a select sample had suggested low levels of knowledge on basic messages relating to fruit and vegetables. This might suggest that in a sample not necessarily as motivated about issues of health, levels would be even lower. As well as the areas investigated before which included recommended servings, knowledge about a link between diet and disease and estimated nutrient content of vitamins and fibre, questions were asked knowledge of antioxidants, specific diseases relating to fruit and vegetables and the calorie content of fruit and vegetables. The additional questions were added to give a broader view of nutritional knowledge relevant to fruit and vegetables with the questions set at a very basic level as previously.

Just over half of the sample was aware of the dietary recommendations on fruit and vegetables and the associations between diet and disease. However when asked about specific health problems relating to fruit and vegetable intake very few people were aware of the links with cancer and heart disease. People tended to mention rickets and scurvy, which may reflect out-of-date knowledge. These misconceptions may be one reason why people are not eating sufficient amounts of fruit and vegetables, as incidence of rickets and scurvy in the UK is very small. Two thirds of participants had heard of antioxidants, but there was no probing into what antioxidants were or where they came from. Previous studies have shown that the majority of people have poor nutritional knowledge and this study supports this. Nevertheless participants who attend dental clinics appear to have greater knowledge about recommendations than the sample attending cancer-screening clinics. Attempts by the government to inform the general public using supermarkets, mass media and medical settings do not appear to be successful. New methods of making people aware of basic nutritional knowledge are needed to enable people to make the appropriate food choices. Dental clinics are already used as an opportunity to tell patients about aspects of diet important to their teeth, such as reducing sugary snacks especially in children and may offer the opportunity to inform people about general healthy eating messages which are likely to have positive outcomes on dental health as well.

Previous results indicated that low fruit and vegetable intake was related to poorer levels of nutritional knowledge in certain groups. As expected there were clear gender differences in all of the nutritional knowledge aspects investigated. More than twice as many women as men were aware of the 5 a day recommendations. There were similar patterns for knowledge about the link with disease, specifically cancer and heart disease and more women had heard of antioxidants. The gender differences in knowledge therefore appear to be universal regardless of the sample. There must be particular reasons why men are not aware of the recommendations and benefits of eating fruit and vegetables. The present study found that there were no gender differences in interest levels in receiving information on diet, so alternatively men may not getting access to or receiving information. More effort is therefore needed to raise awareness in men. We have already hypothesised that the emergence of more magazines about health and fitness for men could be one avenue for raising awareness. There are a limited number of settings which are suitable for targeting men about health issues. Fitness centres and sports clubs are perhaps one such place that information could be displayed. The indications are that the lack of knowledge could be one reason why men do not consume as much fruit and vegetables as women.

There were also other demographic differences in knowledge levels, in relation to age and education, and also lifestyle factors of smoking and dietary status. The oldest and youngest participants have the lowest knowledge levels, possibly as a consequence of out of date information in the old and lack of exposure to information in the young. As expected nutritional knowledge was associated with educational levels, whereby participants with the highest educational levels had the highest nutritional knowledge levels. One way of tackling these educational differences could be to give dietary advice information from an earlier age at school, or to design information that could be read by more people. Both of these ideas would require more effort and piloting being done on intervention programmes before they are administered.

Lifestyle factors of smoking and diet status were also associated with different levels of nutritional knowledge. 'Smokers' had lower levels of knowledge whilst 'dieters' had higher levels of knowledge. Therefore having a 'healthy lifestyle' is consistent not only with a better diet but more knowledge about healthy eating. This may be because 'healthy' people actively seek out more information to make the right choices or are more inclined to visit settings where this information is displayed. For example people on diets will be more likely to visit their GP and diet clubs for advice, where such information is more readily available. It is evident that levels of nutritional knowledge are partly a result of demographic and lifestyle characteristics which further support the hypothesised link between nutritional knowledge and fruit and vegetable intake.

Similar patterns emerged for attitudes in this study as in the cancer-screening sample with the majority of people positive about the taste, availability and preparation of fruit and vegetables. Perceived price, and storage of both fruit and vegetables, and the convenience of vegetable as a snack showed negative attitudes. Additionally there were negative perceptions about fruit and vegetables not being filling and difficult to carry around, which are likely to be barriers to change. The lower calorie content means that they can not always be a substitute for other foods such as high fat snacks. Difficulties in transportation could be for two reasons which are getting to and from shops and also the physical carrying of fruit and vegetables. These are likely to be issues which are more salient to some groups, for example women, the elderly and low SES. One problem with getting to and from shops is that supermarkets tend to be on the outskirts of town and thus require a car or lengthy trips there. The physical weight of fruit and vegetables is something which is difficult to adjust. Again having a car would ease this problem which means that people from lower socio-economic groups are more likely to have problems with this. However attitudes to transportation did not differ by gender, age or SES. Telling people that their beliefs or attitudes are wrong is unlikely to lead to change, much more likely is that environmental change to availability would in the long term make people reconsider their attitudes. This could involve providing better transportation networks to shops, or building shops close to where people live.

There were specific gender differences on a number of the attitudes measured. Women were more positive about the perceived taste, convenience, and weight control properties of both fruit and vegetables. Also they perceived fruit as more filling whilst vegetables were healthier and better for you, than men did. It would be interesting to understand why women tend to be more positive about fruit and vegetables than men. Some factors may be more pertinent for women such as fruit and vegetables being good for weight control. The pressure for women to maintain thinner bodies may contribute to eating foods which are lower in calories. Also a perception by men that fruit is not filling may be related to their need for greater energy (30% more) than women. Fruit and vegetable may be contributing less to their energy needs. Other studies have found that there is a gender conflict in eating behaviour style whereby men are trying to fulfil their energy requirements, while women may be suppressing these in the interests of maintaining a lower body weight (Rolls et al, 1991). This could account for differences in ratings of attitudes about weight control and 'fillingness'. The research on attitudes indicates that women are more positive overall about a variety of factors relevant to fruit and vegetable consumption. The pattern of results suggest that as before, the differences in knowledge and attitudes may account for some of the demographic differences in intake levels.

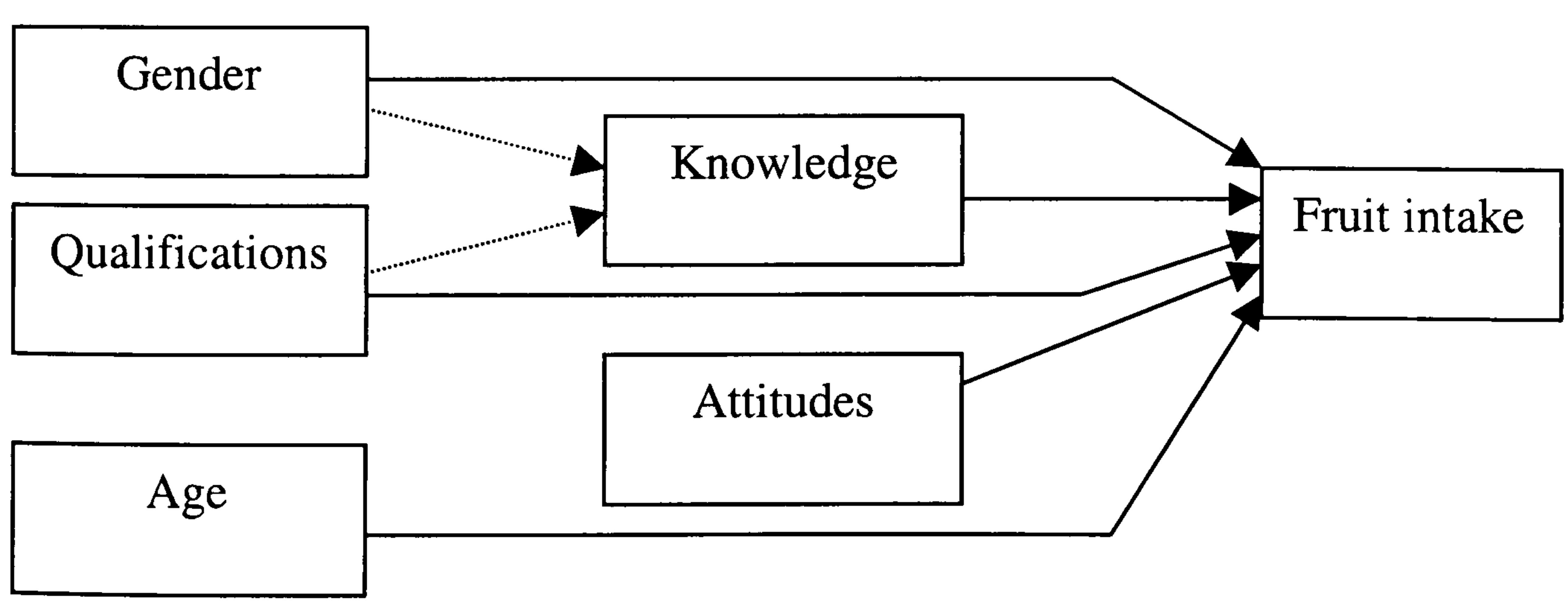
All of the different nutritional knowledge items were associated with intake levels for fruit and vegetables. Some nutritional knowledge items appear to have stronger associations with intake levels than others, for example recommended servings was more correlated (0.37) than nutrient content (0.06-0.12). This may also be so for other dietary behaviour, for example knowledge about recommendations for fat may not be as important as knowing that certain foods contain high fat in them. Research on nutritional knowledge and behaviour has not looked at whether different types of knowledge affect behaviour differently. There is a tendency only to look at overall knowledge levels in relation to behaviour.

The results again suggest that an increase in nutritional knowledge would be likely to produce an increase in intake levels. Therefore it is important to increase nutritional knowledge in the majority of people, but especially in men, those with lower educational levels, participants who are under 25 and over 60 years of age and participants who are less interested in health (e.g. smokers). It is important to ensure that everybody realises the personal relevance of increasing fruit and vegetable intake which may be difficult to achieve in general intervention programmes.

Multivariate analysis was carried out for fruit and vegetables independently to find out which factors could explain the variation in intake levels but also whether knowledge and attitudes mediated demographic differences in intake levels. Using a different kind of sample meant that additionally age, smoking status and diet status could be included as predictors of dietary behaviour. Age, gender, qualification, smoking status and diet status were all independent predictors of fruit intake, however economic deprivation was not. The reasons why economic deprivation was not predictive when all other demographic factors was added may be because of the strong association between educational level and SES.

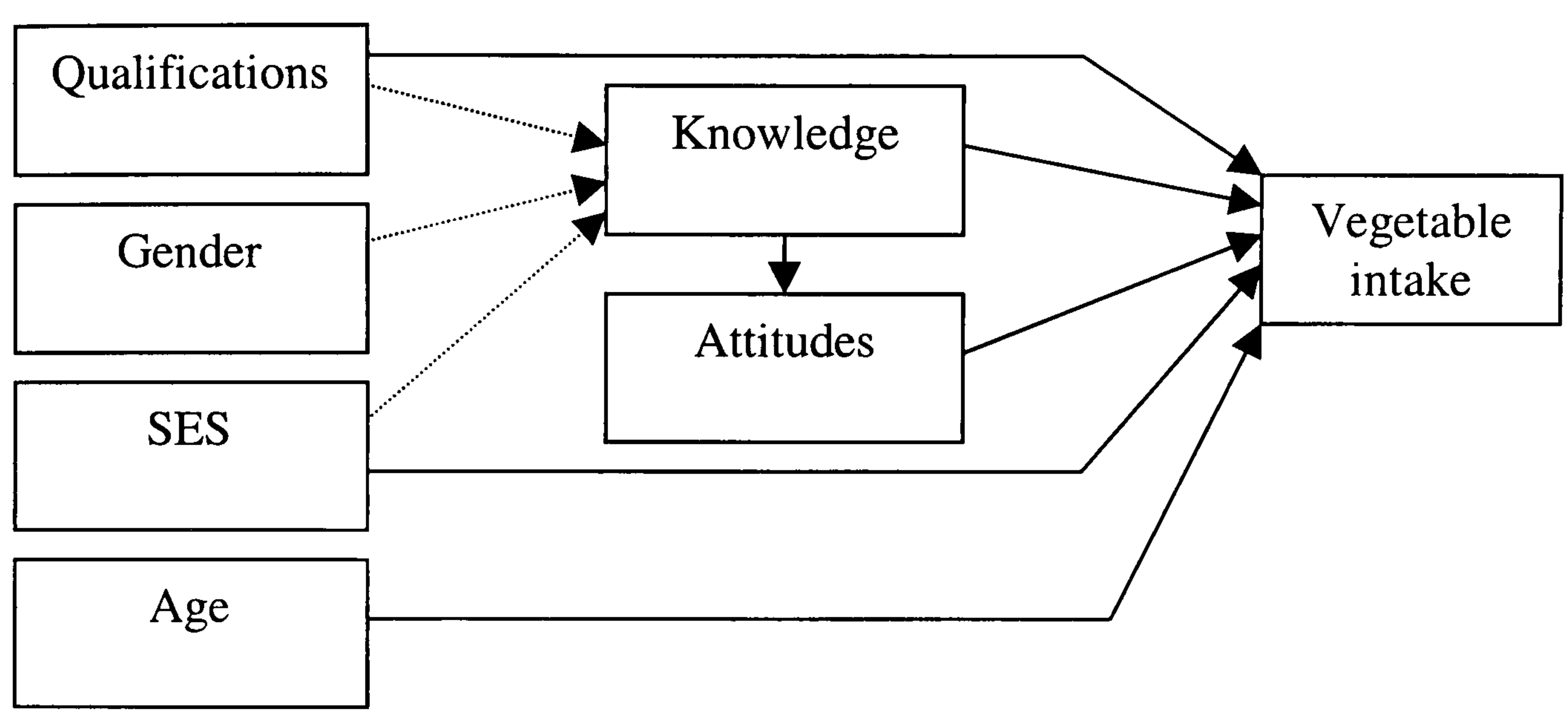
Both knowledge and attitudes were found to be independent predictors of behaviour (See Figure11) with no mediation of knowledge effects by attitudes. Whilst knowledge level did account for some of the gender and education differences in intake, this was only a small effect. Thus gender, age, education, smoking status and diet status all had an independent effect on behaviour. Specific attitudes which independently predicted intake were perceived ease of storage, price and taste of fruit as before in the first study. It can be concluded from these results that differences in levels of knowledge and attitudes account for part, but not all of the demographic variation in intake of fruit.

Figure 11 Demographic, Knowledge and Attitudinal influences on fruit intake



For vegetable intake there was some contrast in the predictors. Whilst most of the demographic predictors were significant predictors of vegetables intake (gender, age, qualification and diet status), smoking status was not, but additionally socio-economic deprivation did predict intake. Nutritional knowledge mediated the effect of gender, qualification and SES on intake of vegetables, thus greater knowledge possessed by women, participants with higher education levels and SES accounted for some of the differences in intake. Only the attitudes for perceived convenience of vegetables as a snack and the taste of vegetables were significant predictors of vegetable intake. Attitudes had a slight mediation effect on the amount of variance explained by educational level although education was still a significant predictor.

Figure 12 Demographic, Knowledge and Attitude influences on vegetable intake



Although more of the variation in intake of fruit and vegetables could be explained by the demographic characteristics, knowledge and attitudes in this study than previously, there are likely to be other specific knowledge and attitude factors which are associated with intake that have not been investigated here.

Grotkowski et al (1986) suggested that the effects of knowledge on behaviour works 'through' attitudes, which were not found in this study. However their study had several methodological drawbacks, with a lack of clear distinction between the knowledge and attitude measures and little variability in rating of knowledge. This might explain the lack of effect, but additionally the select sample (elderly) means that the results can not be generalised to the population.

Methodological factors that were an issue in the first study were addressed prior to development of this study. The main factor to consider in the earlier study was the type of sample used. Therefore it was decided to use a sample that would offer a wider age range and a more representative group of the population. Dental clinics were used as a setting that would be suitable for getting people to fill in the baseline questionnaires thus giving a reasonable response rate. Also it was important to use a setting that would offer an opportune moment for individuals to participate in a dietary intervention because it was salient to the care they were already receiving. However it was evident that the sample were highly educated with more people having degrees than in the general population. Nevertheless the sample had a varied age range and also there was more variation in other socio-economic indicators. Unfortunately it was not possible to determine the reason for attendance at the clinics. This means that some of the sample could be attending for regular check-ups thus were concerned about their dental health and perhaps about their health in general. Other people could have been attending because of a need for treatment and thus had no choice. Dental care is not cheap and therefore people on lower incomes might be less willing to come for care. However people on state benefits, the elderly, pregnant and new mothers all receive their care for free. This may mean that the type of people who attend for treatment either have to have sufficient funds (higher SES) or no funds (very low SES) which may exclude people in the middle. Observation of attendees at the clinics showed a diverse group of people by socio-economic status. Government figures show that approximately 50% of the population are registered with a NHS dentist, however this does not include people who are registered privately or give an indication of attendance figures.

The majority of people asked to complete the questionnaires at the clinics complied (95%) which suggests this is a good setting for data collection. Two of the reasons why data collection is feasible in this setting is that patients have to wait some time for their appointment and thus questionnaire completion occupies their time, but also patients are conscious of their health at that time and may be more inclined to fill in information relevant to their health.

Alterations were made to the questionnaire on reflection from study one. The measure for intake of fruit and vegetables was made more precise and additional measures of knowledge and attitudes were added to give a more in-depth picture of the association between nutritional knowledge, attitudes and intake.

The results from this study confirm the associations identified in the previous study between knowledge, attitudes and behaviour. As before it is difficult to determine causality but a logical assumption would be that increasing nutritional knowledge and improving attitudes would lead to change in intake levels. In path analysis, nutritional knowledge had a direct association with dietary behaviour and did not necessarily work through attitudes. Acquiring knowledge on its own can not be assumed to change behaviour, however it may stimulate people to consider change as a result of reflecting on their current behaviour. It is now important to establish whether the results are replicable with regard predictors of intention and the impact of a tailored intervention in the dental sample.

Chapter 7 Psychosocial predictors of interest and intention to change behaviour in a sample of dental attendees

Introduction

In this chapter we investigate predictors of interest in receiving more information and intention to change fruit and vegetables intake. As in previous chapters we will be using the ASE model (Brug et al, 1995) which postulate that attitudes, self-efficacy and social influences effect intention to change behaviour. This model is an adaptation of the earlier theory of planned behaviour model (Ajzen and Madden, 1986), which has been widely used in examining different health behaviours.

In the earlier chapter we found that the ASE model was not a good predictor of intention to change behaviour in people attending cancer screening clinics. However participants attending cancer screening clinics are likely to more highly motivated about their health than other samples. Whilst attendees at dental clinics are interested in their dental health and thus may have more motivation than people selected from a non-health setting, they do represent a more diverse group of participants.

To gain a further understanding of factors which contribute to intentions to change behaviour we will look at the role of different types of health beliefs, using constructs from the health Locus of Control model (Wallston, Wallston and DeVellis, 1978) which includes locus of control and health values. Internal measure of health locus of control is the perceived self-control an individual places on their health. Norman et al (1998) found that participants with high internal control tended to carry out more health behaviours. However they found that it was not a major predictor of health behaviour and to some extent was mediated by 'health values'. The concept of Health Locus of Control has similarities with self-efficacy. Therefore we can look at the role of specific self-efficacy for dietary behaviour in combination with the less specific health locus of control for general health to see which has more impact. A more recent development of the HLC model has included a measure of 'health values'. Health value is the value an individual places on their health, for example how important their health is to them or how concerned they are about their health. Norman (1995) found that health behaviours such as eating a balanced diet correlated with health value for individuals who value their health highly. Hayes and Ross (1987) who looked at health belief as a motivating factor in healthy diets found an interaction between control of their health and concerns about health.

In this study we examine the relationship between motivation to get more information about a healthy diet, and intention to make particular dietary changes. We believe that psychological concepts from the ASE model will help to explain the differences in both interest and intention for dietary change. The psychological constructs of this model will mediate any differences by demographic characteristics. Furthermore particular health beliefs will further contribute to explaining these differences. Finally we include past behaviour as a predictor of intention, as lifestyle habits may be important in considering change.

Method

Data were collected at dental clinics as part of the same questionnaire described in the previous study Chapter 7.

Measures

Interest in more information

Participants were asked if they would like more information about adopting a healthy diet. There were four possible responses: definitely yes / yes maybe / not sure / definitely not. For some presentations of the results participants were put into two groups 'interested' (answering definitely yes or yes may be and also giving address) or 'not interested' (all other participants).

Intention to eat more

Participants were asked whether they intended to increase their intake of fruit and vegetables within the next 6 months. Those who answered 'yes' were categorised as intenders and those who answered 'no' were classified as non-intenders. There were separate questions for fruit and for vegetables.

Beliefs about fruit and vegetables

Benefits

Two questions were taken from the questionnaire of Study 1 which asked about the benefits of increasing fruit and vegetable intake for preventing cancer and heart disease. These originally came from Trenkner et al's (1990) nutrition attitudes scale, which indexed, perceived benefits and barriers to eating behaviour change. Each question was rated for agreement on a 4 point scale from strongly agree to strongly disagree.

Liking

Liking was assessed by asking subjects to rate how much they like fruit (in general), vegetables (in general) and salads. The individual fruit and vegetables items from Study 1 were combined into groups of fruit, vegetables and salads, based on the pattern of inter-correlations.

Self-efficacy

The same self-efficacy questions were taken from Study 1 based on the SEEB by Sallis et al (1988). Question 1 was modified from 'choose fruit more often for dessert' to usually choose fruit for dessert'. Additionally the 'don't know' category was removed, since it was difficult to interpret don't know on a continuous scale. Subjects were asked a variety of questions on self-efficacy to see if they had confidence in their own ability to change their dietary behaviour.

Social norms

Participants had to rate their intake in comparison to friends and family using a 4 choice scale.

Health beliefs

Disease susceptibility

As before participants were asked about their perceived susceptibility to cancer and heart disease in comparison to friends and family.

Health Values and Locus on Control

Locus of control was measured with questions from Wallston et al's (1978) locus of control questionnaire and health value was measured with questions from Lau, Hartman and Ware (1986) health values questionnaire. Participants were asked 2 questions on both internal health control and health values as listed below using a 4 choice Likert scale from 'strongly agree', 'agree', 'disagree' to 'strongly disagree'. In analysis these have been combined to create a value score and locus of control score.

Table 1 Health value and locus of control questions

Health values	There are few things more important than good health
	If you don't have your healthy you don't have anything
Locus of control	If I take the right actions, I can stay healthy
	I am in control of my health

Demographic characteristics

Questions on age (participants were categorised into 7 ages bands), gender, highest achieved qualification and socio-economic deprivation (indexed by car ownership and housing tenure) were also included.

Results

Sample

The sample consisted of 1846 participants from dental clinics across London with 654 (38%) men and 1075 (62%) women. (described in Chapter 6)

Interest in more information

Participants were asked whether they were interested in receiving more information about adopting a healthy diet. Approximately half of participants indicated an interest in more information and gave their address. Chi Square analysis was used to look at demographic differences in those who wanted more information and those who did not (see Table 2). There were no differences by gender, highest qualification level or age although there were differences by socio-economic deprivation level ($\chi^2 = 7.36$, df[2], $p<0.01$). Surprisingly those participants with higher deprivation levels were more interested in receiving information about adopting a healthy diet.

Table 2 Demographic differences in interest in more information				
	Interested		Not interested	
	n	%	n	%
Total sample	850	47	971	53
Gender				
Men	316	48	338	52
Women	529	49	544	51
Qualifications				
Primary	16	46	19	54
Secondary	257	53	227	47
Trade	96	50	95	50
Diploma	99	49	104	51
Degree	365	47	408	53
Economic deprivation				
High	152	57	115	43
Medium	200	52	186	48
Low	398	48	437	52
Age				
18-24	50	43	67	57
25-34	230	53	201	47
35-44	224	49	232	51
45-54	161	45	198	55
55-64	109	54	92	46
65+	67	45	82	55

Intention to eat more fruit and vegetable

The majority of participants did not have any intention to change their intake. 37% of participants intended to eat more fruit and 30% intended to eat more vegetables. Chi Square was used to look at possible difference in intention to change fruit and vegetable intake (see Table 3). There were differences by socio-economic deprivation for both fruit (χ^2 =23.54, df[2], p<0.001) and vegetables (χ^2 =10.17, df[2], p<0.01). More participants in the higher deprived group intending to increase fruit and vegetables than lower deprivation levels. There were also age differences with a decline in intention by age for fruit (χ^2 =67.56, df[5], p<0.001) and vegetables (χ^2 =15.98, df[5], p<0.001). Participants aged 18-25 years had more intention to change intake levels, with participants aged over 65 years having the least intention.

Table 3 Demographic differences in intention to increase fruit and vegetable intake								
	Intention to increase fruit				Intention to increase vegetables			
	Intention		No intention		Intention		No intention	
	n	%	n	%	n	%	n	%
Total sample	595	37	1011	63	481	30	1133	70
Gender								
Men	217	37	374	63	159	27	425	73
Women	355	37	593	63	295	31	665	69
Qualifications								
Primary	11	38	18	62	4	16	21	84
Secondary	141	34	276	66	110	26	320	74
Trade	71	40	105	60	54	30	123	70
Diploma	74	40	112	60	68	37	117	63
Degree	259	37	441	63	208	30	486	70
Economic deprivation								
High	117	49	122	51	87	36	152	64
Medium	135	38	217	62	103	29	249	71
Low	237	32	508	68	194	26	559	74
Age								
18-24	54	52	49	48	37	35	70	65
25-34	183	46	213	54	136	34	260	66
35-44	173	41	245	59	131	32	284	68
45-54	96	31	217	69	84	26	235	74
55-64	43	24	134	76	42	23	138	77
65+	20	16	101	84	23	20	90	80

Attitudes and beliefs

Beliefs about fruit and vegetables

Health benefits

The majority of participants rated health benefits as high for both fruit and vegetables. See Table 4. More than 78% believed that increasing fruit and vegetable intake would reduce the risk of cancer or heart disease. Women perceived fruit for reducing risk of cancer (t df[1591] = -2.30, $p<0.05$) and heart disease (t df[1554] = -2.68, $p<0.01$) more highly than men although, there were no difference for the health benefits of vegetables.

Table 4 Health benefits of fruit and vegetables								
	Strongly disagree		Disagree		Agree		Strongly Agree	
Fruit	n	%	n	%	n	%	n	%
Reduces cancer	36	2	210	13	1017	62	384	23
Reduces HD	43	3	303	19	900	56	367	23
Vegetables								
Reduces cancer	47	3	312	19	946	58	320	20
Reduces HD	41	2	195	12	1055	63	386	23

Liking of fruit and vegetables

Respondents were asked to rate how much they liked fruit, vegetables and salads overall. The majority of people claimed to like fruit (75%) vegetables (72%) and salads (67%) very much (see Table 5). Liking for vegetables and salads were the most highly correlated (r_s =0.51, p<0.001), with liking for fruit and salads (r_s 0.35, p<0.001) and liking for fruit and vegetables (r_s =0.29, p<0.001) also being significantly correlated. Women rating liking for vegetables (t df[1673] = -3.31, p<0.01) and salads (t df[1674] = -6.21, p<0.01) more highly than men.

Table 5 Liking for fruit, vegetables and salads										
	Dislike very much		Dislike a bit		Neither like or dislike		Like a bit		Like very much	
	n	%	N	%	n	%	n	%	n	%
Fruit	10	1	39	2	91	5	294	17	1290	75
Vegetables	30	2	41	2	95	5	320	19	1244	72
Salads	34	2	57	3	106	6	368	22	1158	67

Self-efficacy for increasing fruit and vegetable intake

Self-efficacy was measured by asking people how confident they were in carrying out specific behaviour. These are presented in Table 6.

The strategy of always keeping fruit in the house was seen as the easiest task to do with 74% of participants definitely able to do it, whilst eating raw vegetables for snacks instead of crackers or crisps was the most difficult with only 27% of participants definitely able to do it.

Table 6 Self-efficacy for dietary behaviours

		Definitely cannot		Probably cannot		Probably can		Definitely can	
Fruit	**n**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Usually choose fruit for dessert	1705	40	2	178	10	859	50	627	37
Always keeping fruit in the house	1722	25	1	50	3	373	22	1273	74
Eating fruit for snacks instead of sweets or cakes	1688	47	3	163	10	757	45	720	42
Vegetables									
Having more than one serving of vegetables with meals	1699	38	2	94	6	577	34	989	58
Eating raw vegetables for snacks	1696	129	8	380	22	730	43	456	27
Having vegetables or salad with both meals	1723	54	3	225	13	693	40	750	44

Confirmatory analysis was conducted using factors analysis to look at self-efficacy factors. Analyses replicated earlier findings for 2 major factors using a varimax rotation. The 'fruit' factor had ratings of between (0.74-0.75) and the 'vegetable' factor had ratings of between (0.62-0.81). Reliability analysis showed moderate internal consistency for fruit (0.68) and for vegetables (0.68). The majority of participants had high levels of self-efficacy for fruit (71%) with less having high levels of self-efficacy for vegetables (56%) (see Table 7). There was a high correlation between self-efficacy ratings for fruit and vegetables ($r_s=0.58$, $p<0.001$).

Table 7 Self-efficacy for fruit and vegetables

	Low		Medium		High	
	n	**%**	**n**	**%**	**n**	**%**
Fruit	17	1	463	28	1264	71
Vegetables	45	3	671	41	926	56

Women had rated self-efficacy for fruit (t df[1600]=-3.65, $p<0.01$) (10.34 vs 10.04) and vegetables (t df[160110]=-6.68, $p<0.01$) (9.90 vs 9.26) more highly than men did (see Table 8). Therefore women were confident about using strategies in order to eat more fruit and vegetables than men.

Table 8 Self-efficacy for fruit and vegetables by gender (min 5-max 15)

	Men		Women	
	Mean scores	**s.d.**	**Mean scores**	**s.d.**
Self-efficacy for fruit	10.0	1.6	10.3	1.5
Self-efficacy for vegetables	9.3	1.9	9.9	1.8

Social influences

Using a social comparison measure it was found that 26% of respondents thought their friends and family ate more fruit and 32% thought that their friends and family ate more vegetables than they did. 31% of men compared with 22% of women thought their family and friends ate more fruit than them, whilst 36% of men compared with 29% of women thought their family ate more vegetables than them. Women generally felt they ate more than their friends and family.

Table 9 Social comparison for fruit and vegetables								
	Strongly disagree		**Disagree**		**Agree**		**Strongly agree**	
	%	n	%	n	%	n	%	n
Vegetables	8	137	66	1128	22	370	63	4
Fruit	7	115	61	1023	28	473	4	65

Health beliefs

Perceived susceptibility to disease

Respondents were also asked about their perceived susceptibility to cancer and heart disease in comparison to somebody of the same age and sex. It was found that 14% of the sample indicated that they thought they had a higher chance of getting cancer and 18% thought they had a higher chance of getting heart disease. There were no gender differences in perceived susceptibility of cancer (χ^2 =6.92, df[4], ns) or heart disease (χ^2 =8.06, df[4], ns).

Table 10 Susceptibility to cancer and heart disease										
	Much lower		**Lower**		**The same**		**Higher**		**Much higher**	
	n	%	n	%	n	%	n	%	n	%
Heart	111	7	469	28	787	47	224	13	90	5
Cancer	93	6	373	22	981	58	186	11	46	3

Health values and locus of control

The majority of participants agreed with the statement that ‘few things are more important than good health’ and also ‘if you don’t have your health, you don’t have anything’. Also the majority of participants felt they were in control of their own health. See Table 11. There were no gender differences in ratings of health values (t df[1616]= -1.14, ns) however women had higher internal locus of control (t df[1630]= -2.50, $p<0.05$) than men.

Table 11 Health value and locus of control

	Strongly disagree		Disagree		Agree		Strongly Agree	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Health values								
There are few things more important than good health	26	2	330	19	1027	61	311	18
If you don't have your health you don't have anything	14	1	16	10	990	58	541	32
Locus of control								
If I take the right actions I can stay healthy	127	7	141	8	612	35	846	49
I am in control of my health	32	2	303	18	690	40	679	40

Past behaviour

More than a third of the sample made changes in the past to their fruit intake (40%) and vegetable intake (36%). More women (43%) had made changes to their fruit intake than men (37%) (χ^2 =6.15, df[1], p<0.05) although their were no difference for vegetable intake with approximately a third of both having made changes.

Univariate analysis of factors associated with interest in more information

Unlike in the previous study participants there was no association of self-efficacy levels with interest in more information. Only three psychological factors differentiated participants who were interested and not interested in more information. These were: perceived susceptibility to heart disease (*t* [1678], 2.44, p<0.05), that cancer risk would be reduced by eating more fruit (*t* [1645], -2.26, p<0.05), and health values (*t* [1666], -2.59, p<0.05). Participants who perceived higher susceptibility to heart disease, rated the cancer protective benefits of fruit higher, and placed a higher value on health, wanted more information (see Table 12).

Table 12 Differences in psychological variables by interest in more information

	More information		No more information	
	Mean	**s.d.**	**Mean**	**s.d.**
Self-efficacy for fruit	10.26	1.58	10.18	1.58
Self-efficacy for vegetables	9.70	1.85	9.60	1.85
Health values	6.24	1.12	6.10	1.07
Locus of control	6.47	1.29	6.43	1.32
Cancer benefit of fruit	3.03	0.70	3.10	0.63
Heart benefit of fruit	2.96	0.74	3.02	0.70
Cancer benefit of vegetables	2.92	0.74	2.98	0.68
Heart benefit of vegetables	3.04	0.68	3.09	0.64
Risk of heart disease	2.88	0.96	2.77	0.89
Risk of cancer	2.83	0.82	2.83	0.77
Liking for fruit	4.62	0.75	4.65	0.72
Liking for vegetables	4.54	0.88	4.60	0.79
Liking for salads	4.46	0.93	4.51	0.87
Social norm for fruit	2.18	0.63	2.24	0.63
Social norm for vegetables	2.27	0.66	2.31	0.64

Predictors of intention to increase intake (see Table 13)

Intention to change intake of fruit was associated with higher perceived risk of cancer (*t* [1495], -3.57, p<0.001), lower ratings of self-efficacy (*t* [1465], 5.06, p<0.001), and higher perceived benefits to cancer (*t* [1459], -2.80, p<0.01) and heart disease (*t* [1431], -2.44, p<0.05) of increasing intake. Additionally participants who intended to increase their fruit intake, rated liking of fruit as lower (*t* [1530], 4.05, p<0.001) and felt that their friends and family ate more fruit than them (*t* [1509], -5.20, p<0.001).

Table 13 Psychological differences by intention to eat more fruit and vegetables

	Fruit				Vegetables			
	Intention		No intention		Intention		No intention	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
Self-efficacy	9.95	1.56	10.38	1.56	9.57	1.80	9.70	1.86
Cancer benefit	3.13	0.65	3.03	0.65	3.03	0.75	2.92	0.69
Heart benefit	3.04	0.73	2.95	0.70	3.14	0.70	3.05	0.64
Health values	6.18	1.11	6.16	1.09	6.18	1.15	6.15	1.09
Locus of control	6.47	1.29	6.44	1.30	6.43	1.37	6.47	1.29
Risk of heart disease	2.84	0.89	2.81	0.92	2.92	0.97	2.78	0.88
Risk of cancer	2.92	0.80	2.77	0.77	2.87	0.79	2.81	0.78
Liking	4.54	0.77	4.70	0.71	4.51	0.83	4.60	0.84
Social norm	2.33	0.68	2.15	0.60	2.33	0.67	2.27	0.63

Intention to change vegetable intake was associated with differences in perceived risk of heart disease (*t* [1505], -2.80, p<0.01), and the perceived cancer (*t* [1470], -2.89, p<0.01) and heart disease (*t* [1506], -2.41, p<0.05) benefits of increasing intake vegetable intake. Higher perceived risk of cancer related to intention to change fruit intake whilst higher perceived risk of heart disease was related to intention to change vegetable intake.

Additionally present intake, perceived adequacy of intake and nutritional knowledge were related to intention levels. Participants who intended to increase intake had lower intake levels, were more likely to perceive their intake as inadequate and had higher levels of nutritional knowledge. However when all three factors were looked at together as predictors of intention, actual intake levels were non significant for fruit (R=0.00, ns) or vegetables (R=0.03, ns). Participants who perceived intake as inadequate were approximately 15 times more likely to intend to increase intake of fruit (R=0.38, p<0.01) and vegetables (R= 0.40, p<0.01).

Association between interest and intention

Using a Spearmans correlation there was a significant correlation between interest in more information and both intention to change fruit intake (r_s =0.11, p<0.001) and intention to change vegetable intake (r_s =0.10, p<0.001). Only a minority of participants both intended to increase intake and wanted more information (20% for fruit, 16% for vegetables). See Table 14.

Table 14 Intention to change behaviour by interest in more information (whole sample)

	Fruit				Vegetables			
	Intention		**No intention**		**Intention**		**No intention**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
More information	328	55(20)	438	43(27)	264	55(16)	498	44(31)
No information	267	45(17)	573	57(36)	217	45(14)	635	56(39)

Multivariate analysis

Predicting interest in more information

A hierarchical logistic regression was used to investigate predictors of interest. Variables were added in 4 blocks which include demographic (gender, age, and education level), psychological factors (self-efficacy, liking, health benefits and social comparison), health beliefs (disease susceptibility, health values and locus of control) and past behaviour. When all 4 blocks were added, the only significant independent predictors of interest in more information were education level, locus of control and past increases in vegetable intake (see Table 15). Participants with lower education levels, lower levels of locus of control and who had made past changes to intake of vegetables were more likely to want more information. Additionally at a marginal level believing that your family and friends at more than you (p = 0.07), placing higher value on health (p = 0.07) and perceiving higher chances of getting cancer (p = 0.07) were significant independent predictors at the final stage.

Table 15 Logistic regression for predictors of interest in more information			
(Hierarchical all blocks entered) **Interest in more information**	**R**	**Sig**	**Odds ratio adjusted** (Exp (B) ∓ In (1.96xSe (B))
Demographic characteristics			
Age	0.00	0.051	1.01 (1.00, 1.15)
Gender	0.00	ns	0.98 (0.75, 1.30)
Qualification	-0.04	ns	0.90 (0.81, 1.00)
Economic deprivation	0.00	ns	0.89 (0.75, 1.07)
Psychological factors			
Self-efficacy	0.00		
Fruit	0.00	ns	1.03 (0.92, 1.15)
Vegetables	0.00	ns	1.04 (0.95, 1.14)
Cancer benefit			
Fruit	0.00	ns	0.91 (0.63, 1.29)
Vegetables	0.00	ns	0.94 (0.68, 1.30)
Heart disease benefit			
Fruit	0.00	ns	1.12 (0.77, 1.62)
Vegetables	0.01	ns	1.25 (0.93, 1.68)
Social comparison			
Fruit	0.00	ns	1.23 (0.91, 1.66)
Vegetables	0.00	ns	0.99 (0.74, 1.33)
Health beliefs			
Health values	0.0.	0.068	1.13 (0.99, 1.30)
Locus of control	-0.04	0.051	0.89 (0.70, 1.05)
Susceptibility to cancer	0.02	ns	1.22 (0.96, 1.54)
Susceptibility to heart disease	-0.01	ns	0.86 (0.80, 1.05)
Past changes in intake			
Fruit	0.00	ns	1.04 (0.77, 1.42)
Vegetable	0.03	ns	1.31 (0.96, 1.79)

Predicting intention to change behaviour

Intention to change fruit intake

A hierarchical logistic regression was used to look at both demographic and psychological predictors of intention to change behaviour using the same 4 blocks used to investigate interest in more information (Table 16). The only significant predictors of intention to change fruit intake were younger age, lower levels for self-efficacy, perceiving family and friends as eating more, higher perceived susceptibility of cancer and past increases in intake. Past behaviour mediated the effect of health beliefs on intention to change behaviour. Participants who had increased their fruit intake in the past were 2.8 times as likely to have intention to increase fruit intake in the future.

Table 16 Logistic regression for predictors of intention to increase fruit intake

Intention to eat more fruit	**R**	**Sig**	**Odds ratio adjusted** (Exp (B) ∓ In (1.96xSe (B))
Demographic characteristics			
Age	-0.13	0.00	0.97 (0.96, 0.98)
Economic deprivation	-0.01	ns	0.87 (0.72, 1.05)
Gender	0.00	ns	1.00 (0.75, 1.33)
Qualification	0.00	ns	1.00 (0.89, 1.11)
Psychological factors			
Self-efficacy	-0.09	0.001	0.84 (0.76, 0.93)
Liking	0.00	ns	0.99 (0.80. 1.23)
Cancer benefit	0.05	0.025	1.39 (0.99, 1.96)
Heart disease benefit	-0.03	0.065	1.05 (0.76, 1.44)
Social comparison	0.06	0.008	1.39 (1.09, 1.77)
Health beliefs			
Health values	0.00	ns	1.07 (0.93, 1.23)
Locus of control	0.00	ns	1.03 (0.91, 1.15)
Susceptibility to cancer	0.05	0.023	1.32 (1.04, 1.68)
Susceptibility to heart disease	-0.03	0.067	0.82 (0.66, 1.01)
Past changes in intake	0.19	0.000	2.65 (1.99, 3.53)

Intention to change vegetable intake

The only independent predictors of intention to increase vegetable intake were lower liking of vegetables and past increases in vegetable intake, although there was a marginal effect of perceived susceptibility to heart disease also (see Table 17). Age effects were mediated by health beliefs and past changes in behaviour, whilst health beliefs mediated the effect of perceived cancer benefits of vegetable intake. Participants who had changed their intake in the past were 2.8 times as likely to intend to change their vegetable intake in the future.

Table 17 Logistic regression for predictors intention to increase vegetable intake

	R	**Sig**	**Odds ratio adjusted**
Intention to eat more vegetables			(Exp (B) ∓ In (1.96xSe (B))
Demographic characteristics			
Age	0.00	ns	0.99 (0.98, 1.00)
Economic deprivation	-0.05	0.037	0.81 (0.67, 0.99)
Gender	0.00	ns	1.19 (0.87, 1.63)
Qualification	0.00	ns	0.97 (0.86, 1.09)
Psychological factors			
Self-efficacy	0.00	ns	0.96 (0.87, 1.06)
Liking	-0.04	0.054	0.82 (0.67, 1.00)
Cancer benefit	0.00	ns	1.13 (0.86, 1.48)
Heart disease benefit	0.04	0.059	1.33 (0.99, 1.79)
Social comparison	0.00	ns	1.00 (0.78, 1.29)
Health beliefs			
Health values	0.00	ns	1.11 (0.95, 1.30)
Locus of control	0.00	ns	0.95 (0.84, 1.08)
Susceptibility to cancer	0.00	ns	0.91 (0.70, 1.17)
Susceptibility to heart disease	0.01	ns	1.18 (0.93, 1.48)
Past changes in intake	0.20	0.00	2.88 (2.12, 3.91)

Summary of results

In this large sample individuals who had an intention to change their intake were more likely to want information relevant to this. However different factors were associated with interest in more information and intention to change behaviour, and the pattern did not correspond with previous predictions. Participants, who were interested in receiving more information, placed greater importance on health values. Those participants who intended to increase fruit intake perceived more health benefits of changing intake but had lower self-efficacy and participants intending to change vegetable intake tended to perceive greater health benefits.

Different factors predicted intention to increase fruit to intention to increase vegetables. For fruit, age, again lower self-efficacy and beliefs about risk of cancer and also part changes in intake were all independent predictors of intake. Whilst for intention to increase vegetable intake, social deprivation level and past behaviour change were the independent predictors. This indicates that the ASE model is useful for explaining intention to change fruit intake but not so effective when looking at vegetable intake.

Discussion

This chapter looks at the psychological factors related to interest in receiving more information about diet, and intention to increase fruit and vegetable intake, in people attending for dental care. As before, components from the ASE model (Brug et al, 1996) have been used for the investigation. In the previous study, using attendees at cancer-screening clinics results did not match those in the existing literature on predictors of intention to change behaviour (Cox et al, 1996), finding no differences in intention levels in relation to attitude, self-efficacy or social norms. It was suggested that this may have been the result of the unreliability of measures used as predictors, and a possible sampling/cohort effect. Therefore it was decided to replicate the analyses on the dental sample taking account of the reliability issues raised in the earlier study. Additionally health value and locus of control were included to see whether these factors would offer better explanation as to people's intentions and interest based on the salience of health at the time of data collection.

The majority of people (63-70%) in this sample did not intend to increase fruit or vegetable intake. This is similar to the earlier study, which also found that most people do not intend to increase fruit or vegetable intake or have not considered it before. Based on the large sample size and good response rates it can be concluded that fruit and vegetable intake is a behaviour that is not necessary at the foremost of people's minds. This seems logical when we consider that there is not much public pressure to eat more fruit and vegetables, unlike the emphasis of reducing fat or increasing fibre. Surprisingly, people who intended to change intake tended to be younger and from lower socio-economic backgrounds. They were also the groups with the lowest intake levels and who perceived their intake as inadequate. Although these are not representative samples, population levels of intention to change are likely to be even lower, since the present samples were distinguished.

Less than half of the sample were interested in receiving more information about diet which is substantially lower than in a cancer-screening sample. However this is a reasonable percentage of participants to recruit for an intervention programme, and may be a reflection of greater concerns about dental health. People from lower socio-economic backgrounds were also more likely to request more information about a healthy diet. It may be that lower socio-economic groups wish to change their behaviour but do not have the means or perceive greater barriers to change, which in turn means that behaviour stays the same. Nevertheless it is encouraging to see that groups of the population who are sometimes omitted in intervention studies because of sampling, are willing to take part at this level.

Interest in receiving more information and intention to change behaviour were associated with one another in this sample, although only a minority of people (16-20%) both intended to increase intake and were interested in more information. Health-related attitudes and beliefs were associated with interest in more information. Different factors were associated with intention to increase fruit intake and intention to increase vegetable intake. Surprisingly lower self-efficacy was related with intention to increase fruit intake, which suggests that the less confident people are of making change, the more intention they have to change that behaviour. On the other hand intention to increase vegetable intake was associated with being aware that fruit and vegetables are healthy. The indications are that intention and interest are associated with different psychological factors, and may represent two quite different components relevant to behaviour change. The results could also be down to chance, and therefore do not offer evidence of the predictors of interest in more information and intention to change behaviour.

The ASE model has been found to predict behavioural intention in relation to smoking (De Vries et al, 1998) but the pattern of findings for diet did not conform in the previous study. It was decided to look again at the viability of the model components for intention and interest. Additional health factors were added to see if they could contribute further to explaining intention to change and interest in receiving more information.

Only health value and health locus of control predicted interest in more information, and these at the marginal level. People who placed higher value on their health but believed they had less control over their health were more likely to want more information. None of the other psychological factors were significant in predicting interest for more information. Changes in health beliefs may be one relevant area to examine in relation to interventions. The reasons why lower locus of control was relevant may be because participants who feel that they do not control their health are somehow trying to do something about it. By getting information on diet they may subsequently feel more in control. However this does not automatically ensure that they will change their behaviour.

Different factors were associated with intention to change fruit intake and intention to change vegetable intake. Intention to increase fruit intake was predicted by self-efficacy, attitudes and social comparison, as well as perceived susceptibility to disease. As before, people who has already made changes to their fruit intake were more likely to intend to eat more. The components of the ASE model were found to predict intention of fruit, as did personal beliefs about risk and past behaviour. However for intention to increase vegetable intake the only significant predictor was past changes to behaviour. Participants who had made previous changes to their intake were 2.8 times as likely to intend to consume more.

The factors studied in this research were selected primarily to find out about people's behaviour so that we could use this information to provide tailored behavioural advice. This may have meant that the questions used were too specific about the processes of behaviour change and less relevant for behavioural intention, which is more attitudinal. The use of theoretical models is widely believed to be a good tool to guide investigation. In this study we have also attempted to explain why people intended to change behaviour, although this was not the focus of the study.

Unfortunately these results shed little or no light on why people intend to change or why they are interested in change. More work needs to be done to see if people's intentions differ by dietary behaviour type (i.e. people show stronger intention for reducing fat than increasing fruit and vegetables). Although the Theory of Reasoned Action and Theory of Planned Behaviour suggest that intention to change behaviour is a good predictor of actual behaviour change, this may not necessarily be so for all behaviours. Some behaviours may require more preconceived thought before people change them than others. People who felt that were consuming adequate fruit and vegetable intake were also less likely to intend to change intake. However perceived adequacy of intake was related to knowledge about recommended levels. People who did not know the recommended levels were more likely to perceived their intake as adequate regardless of actual intake. Therefore a lack of knowledge may be influencing their ability to judge their own behaviour objectively. Whilst Towler and Shepherd (1986) and Shepherd and Stockley (1992) found that knowledge did not contribute to the theoretical explanation of fat intake using the theory of reasoned action, we cannot be certain for fruit and vegetable intake. Alternatively the lack of significant results may be a consequence of using a one item measure of behavioural intention which was not really an adequate index of peoples intention to change behaviour in the next 6 months. Traditionally behavioural intention is measured with a variety of questions which also incorporate desire and expectations, and the time scale for behavioural intention is usually more specific (e.g. tomorrow) than the one used in this study (e.g. sometime in the next 6 months).

Nevertheless there is a pattern evident which suggests that people who have more positive attitudes and more concerns about health are more likely to be interested in having information about dietary change or to intend to change behaviour. Further work is needed to find out what factors are relevant to intentions to increase fruit and vegetable intake. The low level of intention to change apparent in this study, indicate that more needs to be done to motivate people to actively consider change, which could mean addressing beliefs about health. Thus getting people to change their behaviour would need to be addressed at two levels. One which would look at motivating individuals to think about change, and the second would involve giving interventions to enable them to make change. In intervention studies this would mean that intervention programmes would need to be more appealing to the individual.

Chapter 8 The efficacy of a tailored intervention to change eating behaviour, knowledge and attitudes amongst dental attendees

Introduction

In a previous study we examined the efficacy of a tailored intervention in changing eating behaviour, knowledge and attitudes in cancer screening attendees. In this present study we are examining the efficacy of a tailored intervention and a general intervention in psychological and behavioural change in dental clinic attendees.

There are a few studies which have tested the efficacy of a tailored intervention in comparison to a general intervention which was the same for everybody. Brug et al (1996) compared a tailored intervention against a general intervention in a work-site population. Both interventions had an effect on reduction of fat in the diet and there was a significant difference between the 2 groups overall with the tailored intervention resulting in more change. The general intervention group made significant increases to their vegetables intake although there were no differences in either group to fruit intake. However as there was no control group, it is difficult to determine what the effect of the general intervention was. Campbell et al (1994) using a three group design examined the effect of a tailored intervention, general intervention and no intervention group on patients attending general practice clinics. They found a marginal effect of group on total fat intake. When comparing the 2 intervention groups with a control group, the tailored group made significant reductions in daily fat compared to control but there were no differences between the general or control group. Overall there were no differences in intake of fruit and vegetables between any of the groups.

This study has been conducted in dental clinics throughout London. These have been selected to test their appropriateness as a setting for implementing dietary interventions. As has been shown earlier, attendees at dental clinics are more likely to be women, aged between 35 and 65, and from non manual SES groups. This means that we would expect to get a sample from a more varied age range than the previous study although there may be more women overall.

This study involved replicating the analysis of Study 1 to see if the positive changes in the tailored intervention group compared to the control group in intake of fruit and vegetables, knowledge and attitudes as a result of the intervention can be reproduced in a different aged and motivational sample. Secondly the effectiveness of a general intervention compared to a control group for positive behavioural and psychological change will be investigated. Lastly the efficacy of the tailored intervention in comparison to a general intervention will be investigated to look at increases in intake, knowledge and attitudes to test which one is more successful. This study involves a 3 group randomised control study which tested the efficacy of three experimental conditions over time. The hypothesis is that the tailored intervention will be more effective at changing behavioural and psychological factors than the general intervention or no intervention. The significant results found in Study 1 will be replicated in this more representative sample.

Method

The sampling frame for the intervention study comprised respondents to the baseline questionnaire (1829) who had indicated an interest in receiving information about adopting a healthy diet, and given their name and address (n=855) (called study participants).

Participants were randomly allocated to a 'tailored' intervention, a 'general' intervention or control (non-intervention) group, using a random number generation technique on Microsoft Excel. As before, when more than one person from a household was taking part in the intervention study, they were allocated to the same experimental group as the other household member to avoid cross contamination.

Sample size calculations

Power calculations (a priori) were conducted to estimate appropriate sample size to show a change in behaviour of 2 servings of fruit and vegetables a week. Using the Gpower programme, the results indicated that for an effect size of 0.15 (standard deviation = 1.9 from Study 1), a sample of approximately 190 in each condition would provide 90% power, with an alpha set at 0.05 ($F(2,564)=3.02$). The power calculation was based on data from Study 1. 280 participants approximately allocated to each group to cope with possible attrition in the study. Due to higher than expected attrition, a post-hoc power calculation was conducted which showed the response rate of 474, would provide 84% power with alpha set at 0.05 ($F(2, 471)= 3.02$).

Procedure

Participants in the intervention groups were either sent a personalised intervention or a general intervention in the form of a leaflet with a covering letter (see Appendix 2A and 2B). The letter asked them to read the leaflet carefully and informed them that they would be sent another questionnaire in a few weeks time. The controls simply received the follow-up questionnaire.

Developing the interventions

The tailored intervention was refined from the leaflet used with cancer screening attendees. Due to the positive outcomes of that leaflet it was decided to use a similar format. Changes were made after consultation with a dietician about both the information and language used.

The intervention was both personalised and tailored based on information collected at baseline about intake of fruit and vegetables, stages of change, attitudes and nutrition knowledge. (See Appendix 3 for different intervention statements).

Personalisation

The intervention was directed at the individual using their name throughout e.g. "why should you eat more fruit and vegetables Mr Blair" and on the front of the leaflet e.g. "a personal program designed for Mr Blair".

Tailoring

The intervention was tailored to each individual's characteristics collected at baseline. These included:

Intake: feedback about present intake levels was given, along with personalised advice on the amount of change necessary to increase intake to the recommended levels. If participants reported that they already consumed sufficient quantities, they were encouraged to keep their intake up to this level.

Knowledge: feedback was given about beliefs of recommended levels along with information on actual recommended levels (e.g. "the recommendation today is that everyone should eat at least 5 servings a day"). The recommended amount of at least 5 servings a day of fruit and vegetables was emphasised throughout the leaflet.

Participants were also given information about the nutrient content of fruit and vegetables regarding antioxidants, vitamins, fibre and calories based on baseline assessments (e.g.. "You thought that fruit and vegetables contain low levels of vitamins).

More specific information about nutrients was given due to requests in the first study for additional information ("Fruit and vegetables are full of Vitamins A, B, C and E as well as other essential nutrients.").

Information was also given about the cancer and heart disease protective properties of fruit and vegetables taking account of prior knowledge (e.g. "You did not know that eating too little fruit and vegetables is related to many cancers and heart disease. By eating lots of fruit and vegetables you can reduce the risk of you getting many cancers or heart disease later on.").

Additionally there was information specific to nutrient content and health benefits of fruit and vegetables. There was comprehensive information about appropriate serving sizes with examples for many fruit and vegetables. It was also stressed that tinned, frozen and dried fruit and vegetables could be counted as part of the recommended daily amount.

Intention to change: Feedback on intention to change behaviour was given (e.g. "It is important that you think about eating more fruit and vegetables if you are not doing so already. At the moment you are not eating the recommended levels of fruit and vegetables. This leaflet will give you some ideas about why fruit and vegetables are so important and how you can eat more."), and also information on the processes needed to sustain or change behaviour (e.g. "We feel that if you think about the reasons why you should be eating more fruit and vegetables, it will be a lot easier to start doing so."). The theoretical background behind the intervention was based around the work done by Prochaska & DiClemente (1983) on processes of change in smoking cessation, so for example, for participants who were classified as in the precontemplation stage, the focus was on benefits of eating more fruit and vegetables (e.g. "Why don't you think about the extra health benefits you will get from eating more fruit and vegetables. Eating lots of fruit and vegetables is especially important for your long-term health."). Those participants in the decision making stage had information focused on practical ways of increasing intake whilst those in the maintenance stage were encouraged to seek social support and find other ways of resisting relapse. The process information came in the form of different statements. See Appendix F for examples from each stage. Where people were in a different stages of change for fruit and vegetables they were given individual stage information for both.

Attitudes: Reminders about reported negative attitudes (perceived barriers) were given with information and suggestions about how to overcome them. For example if somebody thought that fruit was difficult to keep, they were given ways to store fruit for longer (e.g. "We think you'll find fruit keeps better when stored properly. Don't leave fruit in direct sunlight. Keep it in a cool spot or even in the fridge. Also remember not to pile fruits on top of one another. This will avoid them bruising or going bad. Tinned and dried fruit also count as part of your daily servings. After opening tins of fruit, remember to keep the fruit in the fridge."). At baseline there were 11 different attitudinal factors to choose from for fruit and vegetables. Therefore it was decided that individuals would be given information relevant to their self-rated two most negative 'attitudes for fruit and vegetables. When participants were equally negative on more than two factors, they were given information on the two factors rated most negative by the group as a whole. The reasons why this altered from the previous study were that it was important not to overload participants with excessive information. Information was written for all the attitudinal factors measures. See Appendix 5 for attitude statements.

Message feedback file for tailoring

This contained messages in response to all possible answers at baseline. There were 97 different messages with over 30 million possible combinations of the leaflet. Using Microsoft Excel and Microsoft Word a mail merge document was developed to create interventions based on answers to the baseline questionnaire.

The intervention was developed using information from a variety of sources. Information relating to nutritional knowledge was taken from leaflets provided by the Health Education Authority, Ministry for Agriculture, Food and Fisheries and the Cancer Research Fund. (See Appendix 2 for example of intervention).

General intervention

The general intervention was based on the tailored intervention used in study 1. Again information relating to nutritional knowledge was taken from leaflets provided by the Health Education Authority, Ministry for Agriculture, Food and Fisheries and the Cancer Research Fund. The leaflet was two pages long and was designed in colour. There was a Flesh Readability score (Flesch, 1936) of approximately 70% for each of the statements used in the interventions.

The leaflet gave information about recommended levels of fruit and vegetables per day and the benefits of eating fruit and vegetables. General information about UK dietary levels was included. There was also a section about the nutrient content of fruit and vegetables. Participants were given behavioural strategies to increase fruit and vegetables intake. In both studies we found that storage of fruit and vegetables was the most negative factors associated with intake therefore advice on storage was given for both fruit and vegetables. Lastly information on servings sizes was included.

The 'general leaflet' and the 'tailored leaflet' were presented in exactly the same format. They appeared the same and were both designed to have similar Flesh Readability Levels (approx 70%) and be of similar lengths. The only differences in language used in the general leaflet were text was written in the 3rd person as opposed to the 2nd person in the tailored leaflet. Statements about different aspects of fruit and vegetables were written to reflect UK wide finding and recommendation.

Contact

A contact name and address was supplied so that participants would have a way to deal with queries. This also provided the option of personal contact which has been shown to increase responses to interventions. However nobody used this facility.

Follow-up questionnaire

All participants were mailed a personal letter written on University letterhead attached to follow-up questionnaire 6 weeks after the interventions were sent out. This time period was selected because it gave enough time for people to make behavioural and psychological changes which could not be detected in a shorter time period. Study 1 showed clear behavioural and psychological changes within this time frame.

The questionnaires were two pages long and had participant numbers (allocated at baseline from 1-1849) in the corner of each page to match up with baseline questionnaires. Questionnaires for all three experimental groups were the same. The intervention groups had already been told that they would be contacted to fill in a questionnaire. They were also informed that they would be entered in a prize draw to win vouchers as a thank you for their co-operation in the study. The control group was told that more information was required to update the data so that they could be sent information shortly and also informed about the prize draw. A reminder letter was sent out 3 weeks after this with another copy of the questionnaire, if it had not been returned.

The questionnaire was based on the follow-up questionnaire used in the cancer screening study. However it was refined with some questions being omitted and additional questions being included. Similar behavioural and psychological measures were used to assess change.

Measures

The follow-up questionnaire included the following items: (See Appendix 4). Note similarity to baseline questionnaire.

Fruit and vegetable intake

As at baseline, intake of fruit and vegetables was assessed with self-reported ratings of their intake for both fruit and vegetables. The single item measure asked specifically about recent intake to enable detection of behavioural changes over time.

Perception of adequacy of intake was assessed as at baseline by asking participants to select a box indicating whether they felt they ate too much, about right or not enough fruit and vegetables.

Stages of change

Stages of change was assessed by using the following questions based on baseline assessments.

1) Are you seriously thinking about increasing the amount of fruit/vegetables you eat sometime in the next 6 months? Yes(2)/No (3)

2) If yes, are you planning to make this increase the next month? Yes (decision making)/No (contemplation)

3) Have you ever changed your eating habits in the past to increase the amount of fruit/vegetables in your diet? Yes (maintenance)/No (precontemplation)

4) If yes, how long ago did you make this change?_____ (recent changes)

Are you still eating more fruit/vegetables than you used to? Yes/No

This was included to assess whether participants had progressed to a more advanced stages of change. Stages of change algorithms took account of subjective and objective ratings of intake and behavioural change intentions.

Nutritional knowledge

Nutritional knowledge was re-assessed with the same questions as at baseline. These included questions about health recommendations, disease linked to fruit and vegetable intake, nutrient content (vitamins, fibre and calories) and knowledge about antioxidants.

Attitudes

Attitudinal factors were assessed as at baseline by asking participants about different aspects of fruit and vegetables. At baseline attitudinal factors were ranked in order of the most negative group perception. Therefore only the 6 most 'negative' attitudes for fruit and vegetables were included in the follow-up assessment. For fruit 'good for weight control', 'filling', 'price', 'storage', 'transportation' and 'convenience' were measured, whilst 'convenience', 'transportation', 'price', 'storage', 'ease of preparation' and 'filling' were measured in vegetables. A four point Likert scale from 'strongly agree', 'agree', 'disagree' to 'strongly disagree'.

Intervention characteristics

Participants were asked about leaflets on diet. They had to indicate how important each of the following features would be; tips on how to eat healthily, easy to read, information about serving sizes, personalised for each person, information on diet and health, printed in colour. Participants had to rate from 'not important', 'quite important' to 'very important' on a three point Likert Scale. These items were selected based on the major content characteristics of the intervention, and aesthetic features.

Dental attendance

We also asked participants about frequency of attendance at the dentist or dental hygienist. This was included to give participants a rating for health motivation based on frequencies from 'once every 6 months' (British Dental Association recommendations) to 'only if I need treatment'.

Comments

All groups had the opportunity to make comments at the end of the questionnaire.
Those participants in the non intervention group were mailed a leaflet about increasing fruit and vegetables after the prize draw had taken place. This was done so that they were not disadvantaged in any way from the intervention groups.

Participants in the control group were mailed a leaflet about increasing fruit and vegetables after the final data collection had been conducted.

Results of follow-up data

Baseline differences in participants and non participants

The sample of participants included in the intervention study comprised 855 people (47% of baseline participants) who had requested additional information in the baseline questionnaire and given mailing address. Comparing participant and non-participant groups revealed no significant differences in participant and non participant group characteristics by gender, ethnic group or age (see Table 1). However there were significant differences by highest qualification (χ^2 = 9.82, df[4], p<0.01) and social deprivation level (χ^2 = 13.91, df[2], p<0.001). Participants in the intervention study had lower educational levels and higher deprivation levels.

Table 1 Demographic characteristics by intervention participation

	Non Participants		Participants	
	n	**%**	**n**	**%**
Gender				
Men	327	37	327	39
Women	553	63	520	61
Qualifications				
Primary	17	2	18	2
Secondary	221	26	263	31
Trade	88	10	103	12
Diploma	110	13	93	11
Degree	413	49	36	43
Economic deprivation				
High	107	15	160	21
Medium	184	25	202	2
Low	442	60	393	52
Age				
18-25	66	8	51	6
26-35	209	24	222	26
36-45	237	27	219	26
46-55	190	22	169	20
56-65	86	10	115	14
66+	83	9	66	8
Ethnicity				
White	748	88	704	84
Black	39	5	49	6
Asian	29	3	46	6
Other	38	4	34	4

There were no significant differences in baseline measures of behaviour, knowledge, or attitudes (See Table 2).

Table 2 Mean baselines scores of behaviour, attitudes and knowledge for intervention participants and non participants

	Non participants n = 991	Participants n = 855
Total daily fruit intake	1.61 (1.28)	1.57 (1.30)
Total daily vegetable intake	1.68 (1.17)	1.71 (1.23)
Positive attitudes to fruit (1-4)	2.58 (0.28)	2.58 (0.30)
Positive attitudes to vegetables (1-4)	2.26 (0.33)	2.27 (0.33)
Nutritional knowledge (1-9)	5.87 (2.07)	5.85 (2.01)

There were also no differences in stages of change for fruit or vegetables between participants and non participants. The majority of individuals were in either the precontemplation or preparation stage for fruit and vegetables.

Table 3 Stages of change for fruit and vegetables for participants and non participants

	Non participants		Participants	
Stages of change for fruit				
Precontemplation	482	52	353	43
Contemplation	37	4	42	5
Preparation	189	20	261	32
Action	116	13	85	10
Maintenance	100	11	77	9
Stages of change for vegetables				
Precontemplation	561	62	430	53
Contemplation	27	3	26	3
Preparation	154	17	196	24
Action	31	3	34	4
Maintenance	133	15	126	16

Baseline differences in intervention and control groups

Participants were randomly allocated to tailored intervention (n=285), general intervention (n=285) or control group (n=285), so no demographic or psychological differences were expected. Chi Square analysis comparing the intervention groups and the control group confirmed that there were no demographic differences between the groups (see Table 4).

Table 4 Sample characteristics for intervention groups and control group

	Tailored group		General group		Control group	
	n	%	N	%	n	%
Gender						
Men	112	40	104	37	111	39
Women	171	60	178	63	171	61
Qualifications						
Primary	8	3	4	1	6	2
Secondary	91	32	77	28	95	34
Trade	36	13	37	13	30	11
Diploma	31	11	31	11	31	11
Degree	114	41	129	46	117	42
Economic deprivation						
High	45	18	58	23	57	23
Medium	75	30	55	21	72	29
Low	131	52	143	56	119	48
Age						
18-25	16	6	19	7	16	6
26-35	68	24	78	27	80	28
36-45	72	25	71	25	76	27
46-55	53	19	63	23	53	19
56-65	48	17	32	11	35	12
66+	25	9	19	7	22	8
Ethnicity						
White	227	82	234	85	243	86
Black	15	5	17	6	17	6
Asian	21	8	11	4	14	5
Other	13	5	14	5	7	3

There were no significant differences in intake of fruit (ANOVA df[2, 839], F=1.56, p ns), intake of vegetables (ANOVA df[2, 839], F=0.71, p ns), attitudes to fruit (ANOVA df[2, 789], F=0.93, p ns) and vegetables (ANOVA df[2, 734], F=0.62, p ns) or nutritional knowledge (ANOVA df[2, 583], F=2.02, p ns).

Table 5 Mean baselines scores of behaviour, attitudes and knowledge for intervention group and control groups			
	Tailored **n=285**	**General** **n=285**	**Control** **n=285**
Total daily fruit intake	1.58 (1.34)	1.66 (1.35)	1.47 (1.20)
Total daily vegetable intake	1.64 (1.21)	1.76 (1.21)	1.72 (1.26)
Positive attitudes to fruit (1-4)	2.28 (0.32)	2.25 (0.32)	2.28 (0.34)
Positive attitudes to vegetables (1-4)	2.59 (0.26)	2.59 (0.31)	2.56 (0.31)
Nutritional knowledge (1-9)	5.98 (1.95)	5.95 (1.97)	5.62 (2.10)

There were also no differences in stages of change distributions for fruit ($\chi^2 = 4.76$, df[8], ns) or vegetables ($\chi^2 = 8.84$, df[8], ns) between the intervention group.

Table 6 Stages of change distributions for fruit and vegetables for intervention and control groups						
	Tailored		**General**		**Control**	
Stages of change for fruit						
Precontemplation	120	44	426	46	107	40
Contemplation	16	6	12	4	14	5
Preparation	87	32	84	31	90	33
Action	28	10	29	11	28	10
Maintenance	23	8	22	8	32	12
Stages of change for vegetables						
Precontemplation	150	56	133	49	147	54
Contemplation	7	3	8	3	11	4
Preparation	66	24	73	27	57	21
Action	10	4	8	3	16	6
Maintenance	36	13	48	18	42	15

Follow-up response rates

483 participants (56%) responded to the follow-up questionnaire with 56% response rate (159) in the tailored intervention group, 56% (160) in the general intervention group and 58% (164) in the control group. Another 3% of questionnaires were returned (22 in total) because the recipient had either moved away or not given their full address.

Analyses were conducted to look at demographic and outcome differences between responders and non- responders to the follow-up questionnaires for both the intervention groups and control group at baseline. This was done using Anova and Chi Square analysis to assess for possible confounding factors to changes in outcomes.

Control group

In the control group responders were significantly older (χ^2= 7.20, df[5], p<0.05) and had lower deprivation levels (χ^2 = 4.57, df[2], p<0.05).

Table 7 Baseline differences between responders and non responders to the follow-up questionnaire in the control group

	Responders		**Non responders**	
	n	**%**	**n**	**%**
	163	57	122	43
Gender				
Men	60	37	51	42
Women	102	63	69	58
Qualifications				
Primary	4	2	2	2
Secondary	57	36	38	32
Trade	17	11	13	11
Diploma	18	11	13	11
Degree	64	40	53	44
Economic deprivation				
High	29	20	28	28
Medium	40	27	32	32
Low	79	53	40	40
Age				
18-25	8	5	8	7
26-35	39	24	41	34
36-45	43	26	33	28
46-55	33	20	20	17
56-65	25	15	10	8
66+	15	9	7	6

At baseline, non-responders had consumed significantly fewer servings of fruit ($t= 1.98$, df [277], $p<0.05$) and vegetables ($t= 1.98$, df [277], $p<0.05$), however there were no significant differences in overall nutritional knowledge, or attitudes to fruit or vegetables.

Table 8 Mean baselines scores of behaviour, attitudes and knowledge for control group responders and non responders

	Responders **n = 163**	**Non responders** **n = 122**
Total daily fruit intake	1.59 (1.25)	1.30 (1.11)
Total daily vegetable intake	1.88 (1.22)	1.51 (1.27)
Positive attitudes to fruit (1-4)	2.57 (0.32)	2.56 (0.30)
Positive attitudes to vegetables (1-4)	2.29 (0.34)	2.27 (0.34)
Nutritional knowledge (0-9)	5.64 (2.09)	5.57 (2.12)

There were no differences in baseline stages of change for fruit or vegetables between responders and non responders in the control group.

Table 9 Stages of change distributions for fruit and vegetables

	Responders		**Non responders**	
	n	**%**	**n**	**%**
Stages of change for fruit				
Precontemplation	63	41	44	38
Contemplation	8	5	6	5
Preparation	48	31	42	36
Action	14	9	14	12
Maintenance	22	14	10	9
Stages of change for vegetables				
Precontemplation	82	53	65	55
Contemplation	4	3	7	6
Preparation	31	20	26	22
Action	12	9	4	3
Maintenance	26	17	16	14

Tailored group

In the tailored intervention group responders were older ($\chi^2 = 9.64$, df[5], $p<0.01$) and had lower deprivation levels ($\chi^2 = 11.64$, df[2], $p<0.01$) than non responders.

Table 10 Baseline differences between responders and non responders in the tailored intervention group

	Responders		Non responders	
	n	%	n	%
	160	56	125	44
Gender				
Men	57	36	55	44
Women	100	64	71	56
Qualifications				
Primary	7	4	1	1
Secondary	51	33	40	32
Trade	19	12	17	14
Diploma	20	13	11	9
Degree	58	37	56	45
Economic deprivation				
High	15	11	30	26
Medium	40	29	35	31
Low	82	60	49	43
Age				
18-25	7	4	9	7
26-35	30	19	38	30
36-45	40	26	32	25
46-55	29	19	24	19
56-65	32	20	16	13
66+	18	12	7	6

They also had significantly lower levels of fruit intake (t= 1.98, df [277], $p<0.05$) at baseline although there were no differences in vegetable intake. There were no differences in knowledge or attitudes to fruit between responders and non responders. However responders rated attitudes to vegetables more positively than non responders (ANOVA df[1, 238], F=6.39, $p<0.05$).

Table 11 Mean baselines scores of behaviour, attitudes and knowledge for tailored intervention group responders and non responders		
	Responders **n = 160**	**Non responders** **n = 125**
Total daily fruit intake	1.82 (1.39)	1.28 (1.21)
Total daily vegetable intake	1.72 (1.15)	1.55 (1.28)
Positive attitudes to fruit (1-4)	2.62 (0.24)	2.56 (0.28)
Positive attitudes to vegetables (1-4)	2.33 (0.33)	2.22 (0.29)
Nutritional knowledge (0-9)	6.05 (1.90)	5.90 (2.03)

There were also no differences at baseline in distributions for stages of change for either fruit or vegetables.

Table 12 Stages of change distributions for fruit and vegetables for tailored group responders and non responders				
	Responders		**Non responders**	
	n	**%**	**n**	**%**
Stages of change for fruit				
Precontemplation	66	43	54	45
Contemplation	10	6	6	5
Preparation	47	31	40	33
Action	18	12	10	8
Maintenance	12	8	11	9
Stages of change for vegetables				
Precontemplation	89	58	61	53
Contemplation	3	2	4	3
Preparation	37	24	29	25
Action	7	5	3	3
Maintenance	17	11	19	16

General group

There were similar patterns for responders in the general intervention groups with them being older (χ^2 = 12.79, df[2], p<0.01) than non responders.

Table 13 Baseline differences between responders and non responders in the general intervention group

	Responders		Non responders	
	n	%	N	%
	160	56	125	44
Gender				
Men	52	33	52	43
Women	108	67	70	57
Qualifications				
Primary	0	0	4	3
Secondary	43	27	34	29
Trade	22	14	15	13
Diploma	20	12	11	9
Degree	75	47	54	46
Economic deprivation				
High	27	18	31	28
Medium	34	23	21	19
Low	86	59	57	52
Age				
18-25	5	3	14	12
26-35	37	23	37	31
36-45	43	27	28	24
46-55	40	25	23	19
56-65	20	13	12	10
66+	14	9	5	4

Responders also consumed more fruit ($t = 3.45$, df [278], $p<0.01$) and vegetables ($t = 3.77$, df [276], $p<0.01$) at baseline than non responders.

Table 14 Mean baselines scores of behaviour, attitudes and knowledge for general group responders and non responders		
	Responders n = 160	Non responders n = 125
Total daily fruit intake	1.90 (1.37)	1.35 (1.26)
Total daily vegetable intake	1.99 (1.23)	1.46 (1.12)
Positive attitudes to fruit (1-4)	2.59 (0.31)	2.60 (0.32)
Positive attitudes to vegetables (1-4)	2.24 (0.29)	2.27 (0.35)
Nutritional knowledge (0-9)	6.07 (1.80)	5.78 (2.20)

There were also no differences in distributions of stages of change between responders and non responders.

Table 15 Stages of change distributions for fruit and vegetables for general group responders and non responders				
	Responders		Non responders	
	n	%	n	%
Stages of change for fruit				
Precontemplation	72	46	54	46
Contemplation	5	3	7	6
Preparation	45	29	39	33
Action	23	15	6	5
Maintenance	11	7	11	9
Stages of change for vegetables				
Precontemplation	70	47	63	52
Contemplation	3	2	5	4
Preparation	41	27	32	27
Action	4	3	4	3
Maintenance	31	21	17	14

Effects of the intervention

The data was analysed in different sections to investigate the effects of the different interventions on both behavioural and psychological factors. Initially the data have been analysed as a replication of the analysis conducted on the flexi-scope intervention data. One tailed analysis has been used to investigate increases in psychological and behavioural factors as a result of the interventions.

Replication of Study 1

Nutritional knowledge at follow-up

Estimated recommended servings

Changes in nutritional knowledge were observed and showed positive change for the tailored intervention group on several elements when compared to the control group. Using a MANOVA there was an increase in the estimation of health recommended daily servings of fruit and vegetables from 4.3 to 5.2 in the intervention group, with a significant group by time interaction ($F(1,310) = 7.84$, $p<0.01$). There were no significant increases in estimated recommended servings for the control group (see Table 16).

Table 16 Changes in estimates of recommended number of daily servings of fruit and vegetables

	N	Fruit intake Baseline	Vegetable intake Follow-up
Tailored intervention	156	4.34 (1.64)	5.15 (1.72)
Control	163	4.06 (1.71)	4.35 (1.62)

Significantly more people in the tailored intervention group knew about the 5 a day message at follow-up (76%) than in the control group (63%) ($\chi^2=5.37$, df[1], $p<0.05$).

Knowledge of diet and disease relationship

There was a significant difference in the proportion knowing about the diet and disease association between the tailored intervention group (74%) and the control group (61%) at follow-up ($\chi^2 = 4.87$, df[1], $p<0.05$) with more participants in the intervention group aware of diseases related to intake of fruit and vegetables (see Table 17).

Using a Wilcoxan paired T-test shows that significantly more people in both the tailored intervention group (n=132, Z=-3.41, $p<0.001$) and the control group (n=149, Z=-2.56, $p<0.05$) were aware of the link after the intervention, but the effect was considerably larger in the tailored intervention group.

Table 17 Percentage of respondents saying they were aware of diseases related to fruit and vegetable consumption				
	Baseline		**Follow-up**	
	n	**%**	**n**	**%**
Tailored intervention	87	55	118	74
Control	83	51	102	62

Significantly more participants in the tailored intervention group were aware of the link between diet and cancer and heart disease at follow-up (χ^2 =17.12, df[6], p<0.001). A third of the tailored intervention group named both cancer and heart disease as related to fruit and vegetable intake at follow-up compared to only 11% at baseline. This compares with an increase from only 13% to 18% in the control group being aware of the link between cancer/heart disease and diet.

Table 18 Knowledge about diseases related to fruit and vegetable consumption				
	Tailored intervention		**Control**	
	n	**%**	**n**	**%**
Did not specify a disease	41	26	62	38
Cancer alone	28	18	29	18
Heart disease alone	14	8	9	5
Other problems (rickets, scurvy etc.)	19	12	36	22
Both cancer and heart disease	55	35	28	17

Nutrient content

There were differences in the proportions of participants correctly rating the amount of fibre (χ^2 =3.66, df[1], p=0.06 (0.03 one tailed)) and vitamins (χ^2 =9.73, df[1], p<0.001) in fruit and also the amount of fibre (χ^2 =2.83, df[1], p=0.09 (0.045 one tailed)) and vitamins (χ^2 =3.35, df[1], p=0.07 (0.035 one tailed)) in vegetables at the marginal level. There were no differences in estimations about the calorie content of fruit or vegetables. Also there were no changes in the proportion of participants who had heard of antioxidants before and after the intervention for the intervention (69%>78%) or control groups (69%>73%).

Table 19 Correct nutrient content estimation of fruit and vegetables (%)				
	Tailored		**Control**	
Fruit	**Baseline**	**Follow-up**	**Baseline**	**Follow-up**
Vitamins	77	85	70	72
Fibre	48	55	53	45
Calories	64	74	66	76
Vegetables				
Vitamins	73	76	67	69
Fibre	74	76	72	69
Calories	71	77	66	79

Attitudes

There was a significant increases in attitudes to ease of storage (t=1.77, df[151], p=0.08 (0.4 one tailed) and perceived expense (t=2.32, df[149], p<0.05 (0.025 one tailed) of fruit and also of convenience of vegetables as a snack (t=1.77, df[151], p=0.08 (0.04 one tailed) and vegetables being 'filling' (t=2.87, df[150], p<0.005 (0.002 one tailed) in the tailored intervention group. The control group coincidentally also made an increase in attitude about vegetables being filling (t=2.80, df[156], p<0.01 (0.003 one tailed). Using a MANOVA there was a group by time interaction on perceived expense of fruit between the tailored intervention and control group (MANOVA df[1,309], F=5.65, p<0.05) only, with intervention participants being more positive.

Table 20 Mean Attitudinal factors to fruit and vegetables at baseline and follow-up (Scale 1-4)					
Attitudes	**Group**	**Fruit**		**Vegetables**	
		Baseline	**Follow-up**	**Baseline**	**Follow-up**
Transportat	**Tailored**	2.92	2.82	2.72	2.52
	Control	2.94	2.83	2.71	2.54
Filling	**Tailored**	2.61	2.69	2.76	2.95 *a*
	Control	2.73	2.69	2.78	2.94 *a*
Quality	**Tailored**	2.91	3.01		
	Control	3.01	2.98		
Storage	**Tailored**	2.42	2.51*a*	2.55	2.58
	Control	2.49	2.51	2.51	2.58
Preparation	**Tailored**			2.94	2.90
	Control			2.96	2.97
Price	**Tailored**	2.41	2.52 *a,b*	2.73	2.86
	Control	2.61	2.55	2.91	2.90
Convenienc	**Tailored**			2.60	2.76 *a*
	Control			2.66	2.70
Weight	**Tailored**	3.14	3.23		
	Control	3.20	3.13		

a= significant difference over time

b= significant interaction between group over time

Stages of change

Differences between groups

At baseline there were no significant differences in distribution of stages of change between the tailored intervention group and the control group. For simplicity contemplation and decision making have been combined as one category, as have action and maintenance due to the length of time for follow-up. At follow-up there were significant differences in change of stages of change for fruit between the control group and intervention group (χ^2 = 5.11, df[2], p=0.09 (one tailed 0.045) with more people in the intervention group progressing from precontemplation to decision-making or action, or from decision-making to action. Results were similar for vegetable 'stages' (χ^2 = 18.38, df[2], p<0.001 (one tailed 0.001), with more people in the intervention group progressing from precontemplation to decision-making or action, or from decision-making to action.

Figure 1 Stages of change for fruit

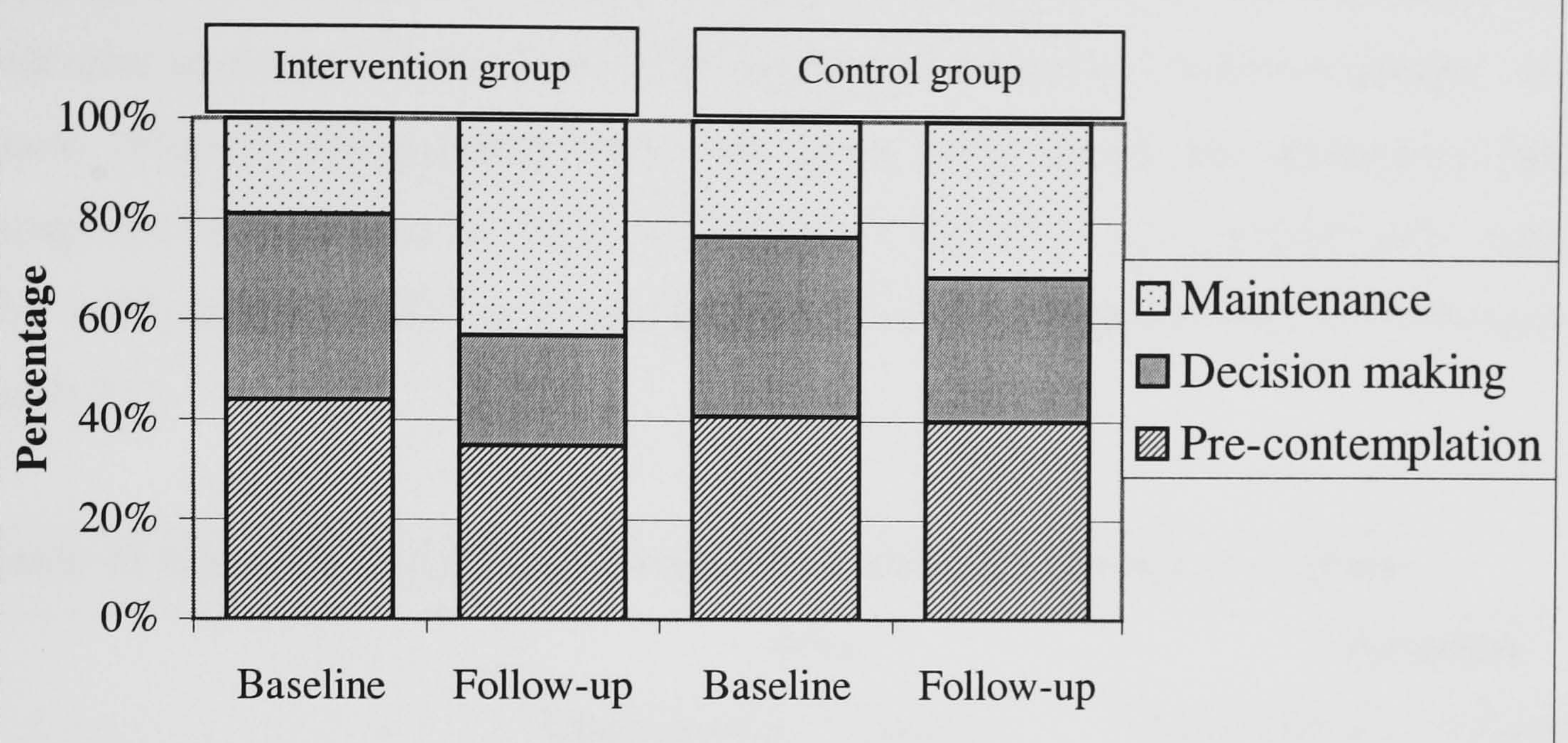
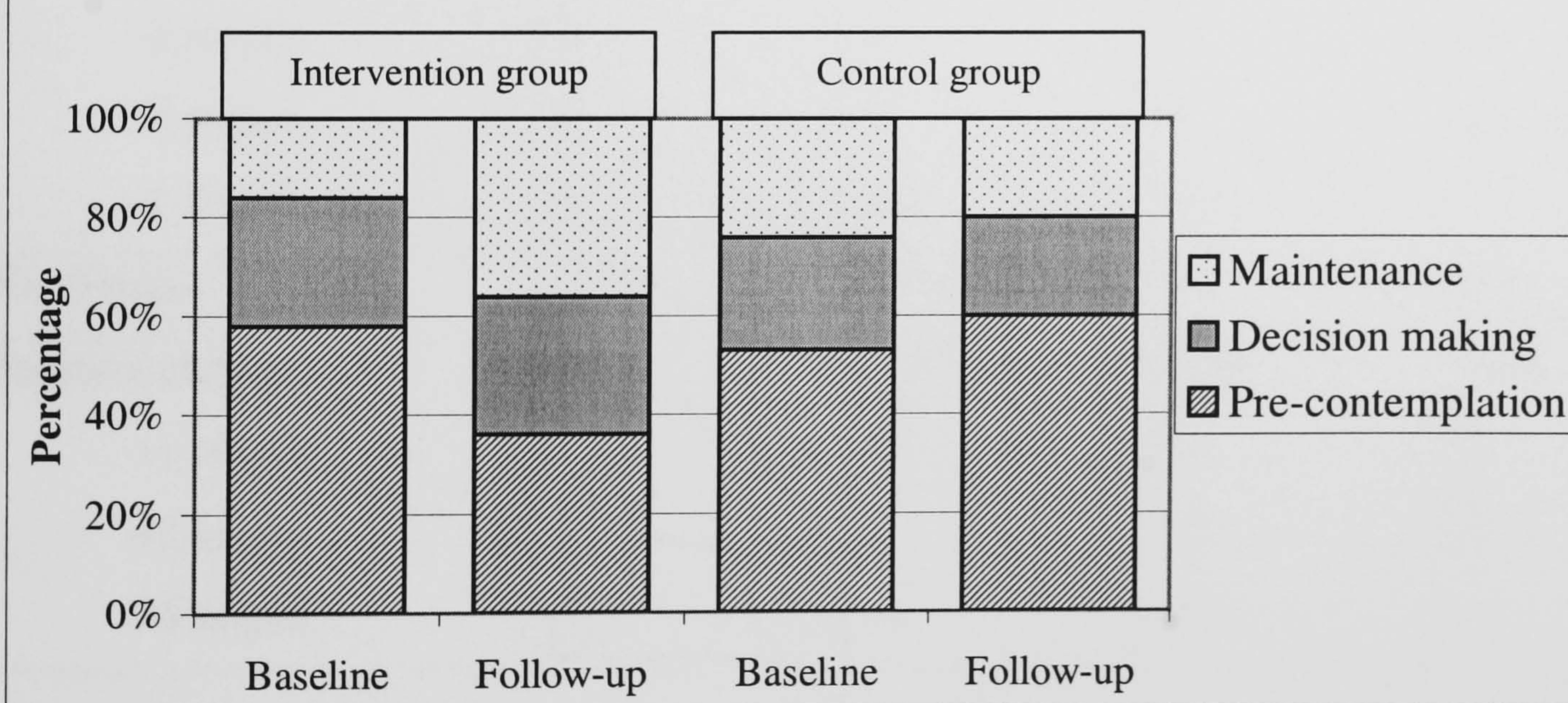


Figure 2 Stages of change for vegetables



Differences within groups

A Wilcoxon-Matched-Pairs Test was used to test for differences over time and it was found that there was a significant difference over time for the intervention group for both stages of change for fruit ($Z = -3.27$, $p<0.001$) and vegetables ($Z= -4.64$, $p<0.001$). In the intervention group, the number of participants increased by 24% for maintenance group (having made behaviour change) for fruit. Whilst the tailored intervention group also increased the number of participants in the maintenance group by 20% for vegetables. There were no significant differences between baseline and follow-up for stages of change for either fruit (Z= -0.99, p ns) or vegetables (Z= -1.49, p ns) in the control group.

Differences in change of stage between groups

The data were also examined within each group separately to look at changes in stage over time to assess whether there were significant differences between groups. Using a Mann Whitney Independent Pairs Test there were significant differences between groups for both changes in stages of change for fruit (Z = -2.10, p<0.05) and vegetables (Z= -4.38, p<0.01) with the intervention group making significantly more changes (see Table 21).

Table 21 Changes in stages of change for fruit and vegetables by group

	Fruit		**Vegetables**	
	Intervention	**Control**	**Intervention**	**Control**
Negative change	(19)	(29)	(16)	29)
-4 stages	4	4	1	11
-3 stages	3	4	1	3
-2 stages	4	7	6	8
-1 stages	8	14	8	7
No change	43	44	41	51
Positive change	(46)	(31)	(41)	(19)
+1 stages	17	12	13	9
+2 stages	7	5	13	5
+3 stages	22	14	15	5

Dietary data

Changes in intake within and between the tailored intervention group and the control group were investigated using a repeated measures analysis of variance (MANOVA). There was a marginal interaction between groups over time for both fruit (F(1,316) = 2.93, p=0.09 (0.045 one tailed)) and vegetables (F(1,314) = 3.80, p=0.05 (0.025 one tailed)).

Table 22	Changes in daily servings of fruit and vegetables				
		Fruit intake		Vegetable intake	
	n	Baseline	Follow-up	Baseline	Follow-up
Tailored intervention	156	1.85 (1.41)	1.99 (1.33)	1.73 (1.16)	1.88 (1.12)
Control	163	1.55 (1.21)	1.49 (1.49)	1.86 (1.20)	1.80 (1.12)

The data was further analysed for within group differences using a Paired samples T-test. At follow-up it was found that the tailored intervention group had marginally increased their intake of vegetables from 1.73 servings to 1.88 servings a day (t=-1.81, df=155, p=0.07 (0.037 one tailed)), and fruit from 1.85 to 1.99 (t=1.32, df=156, p=0.18 (0.09 one tailed)). The increases in the tailored intervention group (0.16 for fruit and 0.18 for vegetables) were equivalent to an increase of approximately 1 serving of fruit and 1 serving of vegetables a week (see Table 22). There were no significant increases in the control group for fruit or vegetables. In percentage terms the intervention group increased their fruit intake by 8% and their vegetable intake by 9% compared to decreases of 4% for fruit intake and 3% for vegetables intake in the control group. 38% of the tailored intervention group were now consuming at least 5 servings a day

General intervention group versus control group

The data was analysed to look at differences between the general intervention group and the control group.

Nutritional knowledge at follow-up

Estimated recommended servings

Changes in nutritional knowledge were observed and showed positive change for the general intervention group on several elements when compared to the control group. The general intervention group increased their estimate of recommended servings from 4.3 to 4.7 (t=3.27, df=154, p<0.01). However using a MANOVA showed there was no group by time interaction for changes in recommended serving estimates (F(1,312) = 0.55, ns). Significantly more participants in the general intervention group (72%) were aware of the 5+ a day recommendations at follow up (χ^2 =3.68, df[1], p=0.05).

Knowledge of diet and disease relationship

There were no significant differences in percentage of people who knew about diseases related to intake at baseline (χ^2 =0.53, df[1], ns) between the two groups. There was a significant difference between the general intervention group and the control group at follow-up (χ^2 =7.13, df[1], p<0.01), with more participants in the general intervention group aware of diseases related to intake of fruit and vegetables (see Table 23).

Table 23 Percentage of respondents saying they were aware of diseases related to fruit and vegetable consumption

	Baseline		Follow-up	
	n	**%**	**n**	**%**
General intervention	88	55	119	74
Control	83	51	102	62

Significantly more participants in the general intervention group were aware of the link between diet and cancer and heart disease at follow-up (χ^2 =17.12, df[6], p<0.001). 28% of the general intervention group named both cancer and heart disease as diseases related to fruit and vegetable intake at follow-up compared to only 16% at baseline.

Nutrient content

Estimations about the nutrient content of fruit and vegetables were measured before and after the intervention. There were significant differences in the proportions of participants correctly rating the amount of vitamins in fruit (χ^2 =3.83, df[1], p=0.05 (0.025 one tailed)) and vegetables (χ^2 =2.87, df[1], p=0.09 (0.045 one tailed)) after the general intervention. 80% of participants correctly estimated the vitamin content of fruit whilst 76% correctly estimated vitamin content for vegetables. There were no differences in estimations about the fibre or calorie content of fruit or vegetables at follow-up. However significantly more participants had heard of antioxidants in the general (85%) group at follow-up compared to the control group (73%) (χ^2 = 6.72, df[1], p<0.01).

Attitudes

There were no significant differences in any of the attitude factors measured between groups over time. Neither the general intervention group or the control group increased their attitudes to fruit or vegetables.

Stages of change

At follow-up there were no differences in change of stages of change for fruit between the control group and intervention group, although more people in the general intervention group progressed from precontemplation to decision-making or action, or from decision-making to action for stages of change for vegetables (χ^2 = 7.45, df[2], p<0.05 (one tailed 0.01).

Table 24 Stages of change at follow-up for general intervention and control groups (%)

	Fruit		Vegetables	
	General intervention	**Control**	**General intervention**	**Control**
Precontemplation	40	39	44	60
Cont/Preparation	22	29	30	20
Action/Maintenance	38	32	26	20

A Wilcoxon-Matched-Pairs Test was used to test for differences over time and it was found that there was a no significant difference over time for the general intervention group for stages of change for vegetables (Z= -1.98, p<0.05) although there were positive changes in stages of change for fruit (Z= -0.43, ns). In the general intervention group, the number of participants increased by 14% for action/maintenance group (having made behaviour change) for fruit.

The data were also examined within each group separately to look at changes in stage over time to assess whether there were significant differences between groups. Using a Mann Whitney Independent Pairs Test-Matched-Pairs Test there were no significant differences between groups for either changes in stages of change for fruit (Z = -1.33, ns) and vegetables (Z= -1.43, ns) .

Dietary data

There were no increases in fruit (t=0.73, df=158, ns) or vegetables (t=-0.17, df=157, ns) intake in the general intervention group over time.

Table 25 Changes in daily servings of fruit and vegetables					
		Fruit intake		**Vegetable intake**	
	n	**Baseline**	**Follow-up**	**Baseline**	**Follow-up**
General intervention	158	1.90 (1.37)	1.87 (1.40)	2.01 (1.24)	2.08 (1.29)

Tailored group versus general intervention group

The data was analysed to look at differences between the tailored intervention group and the general intervention group.

Nutritional knowledge

Using a MANOVA there was a significant group by time interaction for changes to estimated recommendations (MANOVA df[1,304], F= 5.48, $p<0.05$) with the tailored intervention group making greater changes in estimations. However there were no differences in knowledge about diseases related to diet, estimated nutrient content of fruit and vegetables or knowledge about antioxidants between the two intervention groups.

Attitudes

There were no significant differences in any of the attitude factors measured between groups over time.

Stages of change

Differences between groups

At follow-up there were no significant differences in stages of change for fruit between the tailored intervention and the general intervention group, however for stages of change for vegetables more people in the tailored intervention group were in the decision-making and action stages ($\chi^2 = 3.75$, df[2],p=0.05 (one tailed 0.025).

Differences in change to stages of change between groups

Using a Mann Whitney Independent Pairs Test-Matched-Pairs Test there was not a significant difference between groups for changes in stages of change for fruit (Z -0.83, ns) although there was a difference in stage for change of change for vegetables (Z= -2.85, $p<0.01$) with the tailored intervention group making significantly more changes.

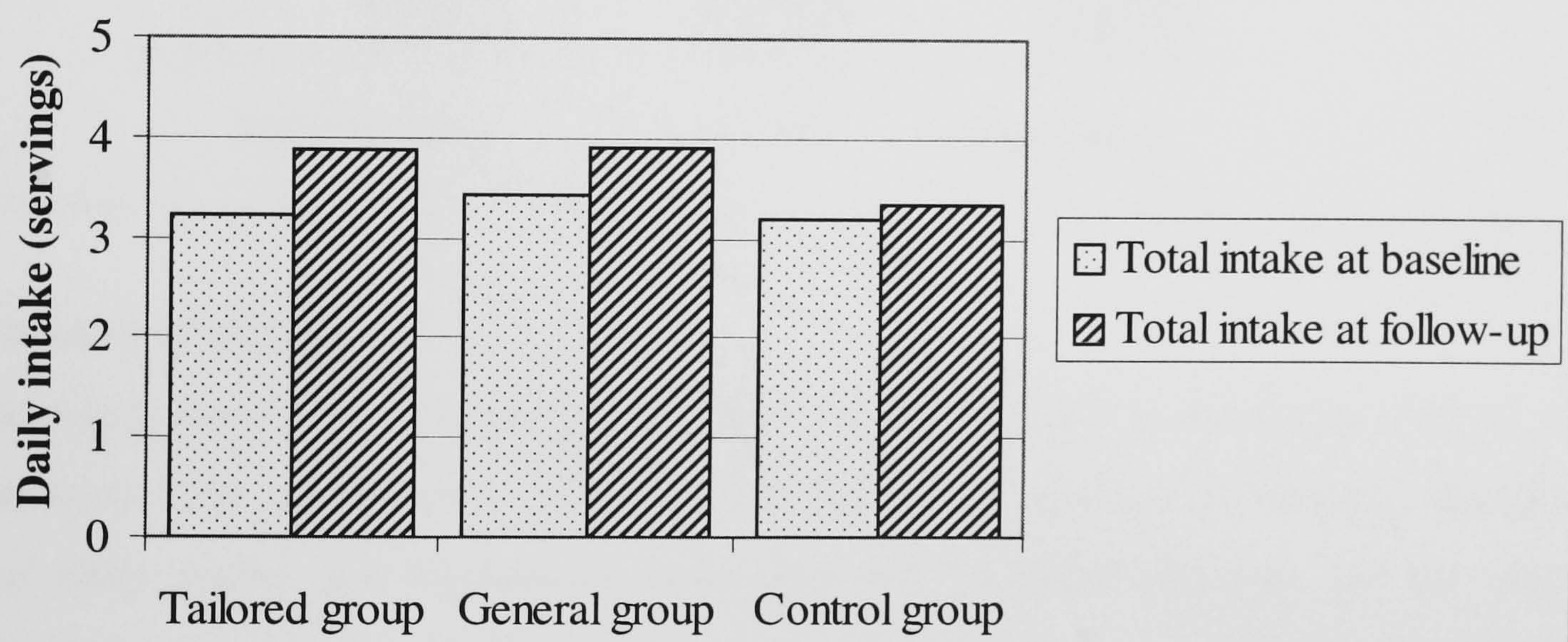
Dietary data

There were no group by time interactions for changes in fruit intake (MANOVA df[1,311], F= 1.43, ns) or vegetable intake (MANOVA df[1,311], F= 0.59, ns).

Three group analysis

Group by time effects were examined for fruit, vegetable and total intake as well as estimated recommendations. Although there were no interaction between group over time for fruit (MANOVA df[1,472], F= 1.77, ns (0.08 one tailed)) or vegetables (MANOVA df[1,471], F= 1.77, ns (0.08 one tailed)) when total daily intake was examined there was a significant interaction (MANOVA df[1,469], F= 2.91, p=0.056 (0.03 one tailed) (see Figure 3).

Figure 3 Total daily intake of fruit and vegetables at baseline and follow-up

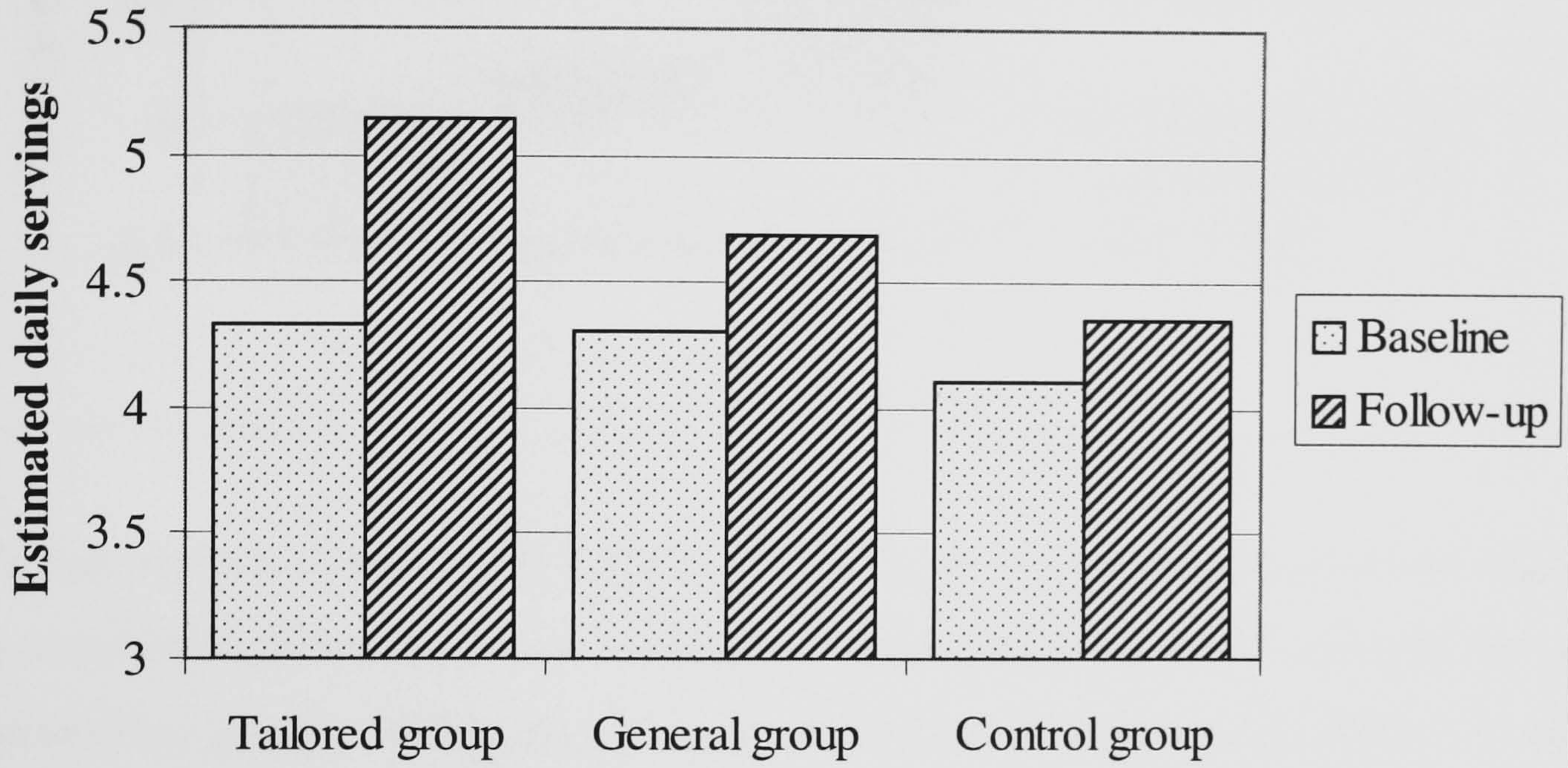


Intention to treat analysis

An 'intention to treat' analysis was conducted to look at a possible biased effect of only including participants who returned follow-up questionnaires (56%). Therefore analysis was conducted on the effects of the intervention for all participants taking part in the study. All non-responders were assigned the baseline intake level for fruit and vegetables as there was no apparent increase in intake in the control group for either fruit or vegetable over the period of the intervention. Using a Manova there was not a significant interaction between groups over time for either fruit intake (F[1,839]= 1.87, ns) and vegetable intake (F[1,839]= 2.09, ns). However there was a significant interaction between groups over time for total intake of fruit and vegetables (F[1, 833]=3.20, p<0.05). Therefore it can be concluded that the intervention does have an impact on combined intake of fruit and vegetables even when we take account of possible bias from non responders.

There was a significant group by time interaction for increases in estimations of recommended levels (MANOVA df[1,463], F= 4.81, $p<0.01$) (see Figure 4).

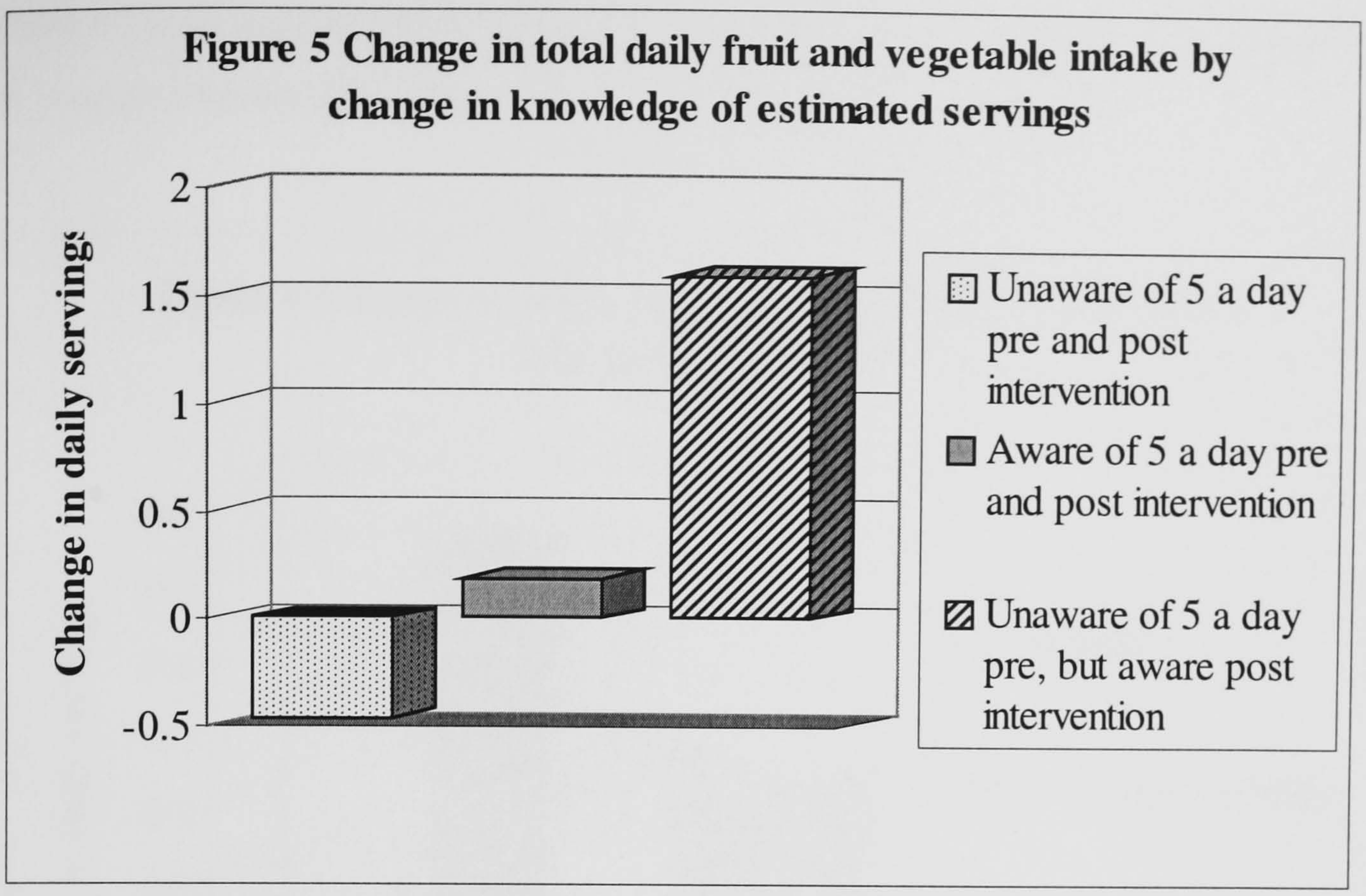
Figure 4 Changes in recommended serving estimations



Processes of change

The associations between changes in behaviour and changes in knowledge factors were examined with correlations. There was a significant correlation between changes in total daily intake and changes in estimated recommended servings for the tailored intervention group ($r_p= 0.27$, $p<0.01$) and the general intervention group ($r_p=0.24$, $p<0.01$) only.

To look at changes in recommended levels three groups were defined: participants who did not know the recommended level before or after the intervention (no change), participants who knew about recommended levels before and after the intervention (no change) and participants who did not know about recommended levels before but did know after the intervention (change). There were significant differences in the tailored intervention group (see Figure 5) between the three identified groups with the knowledge change group showing the largest increases in consumption of fruit and vegetables (F [2, 140], = 10.19, $p<0.001$) but no changes in the general intervention group (F [2, 146], = 0.57, ns).

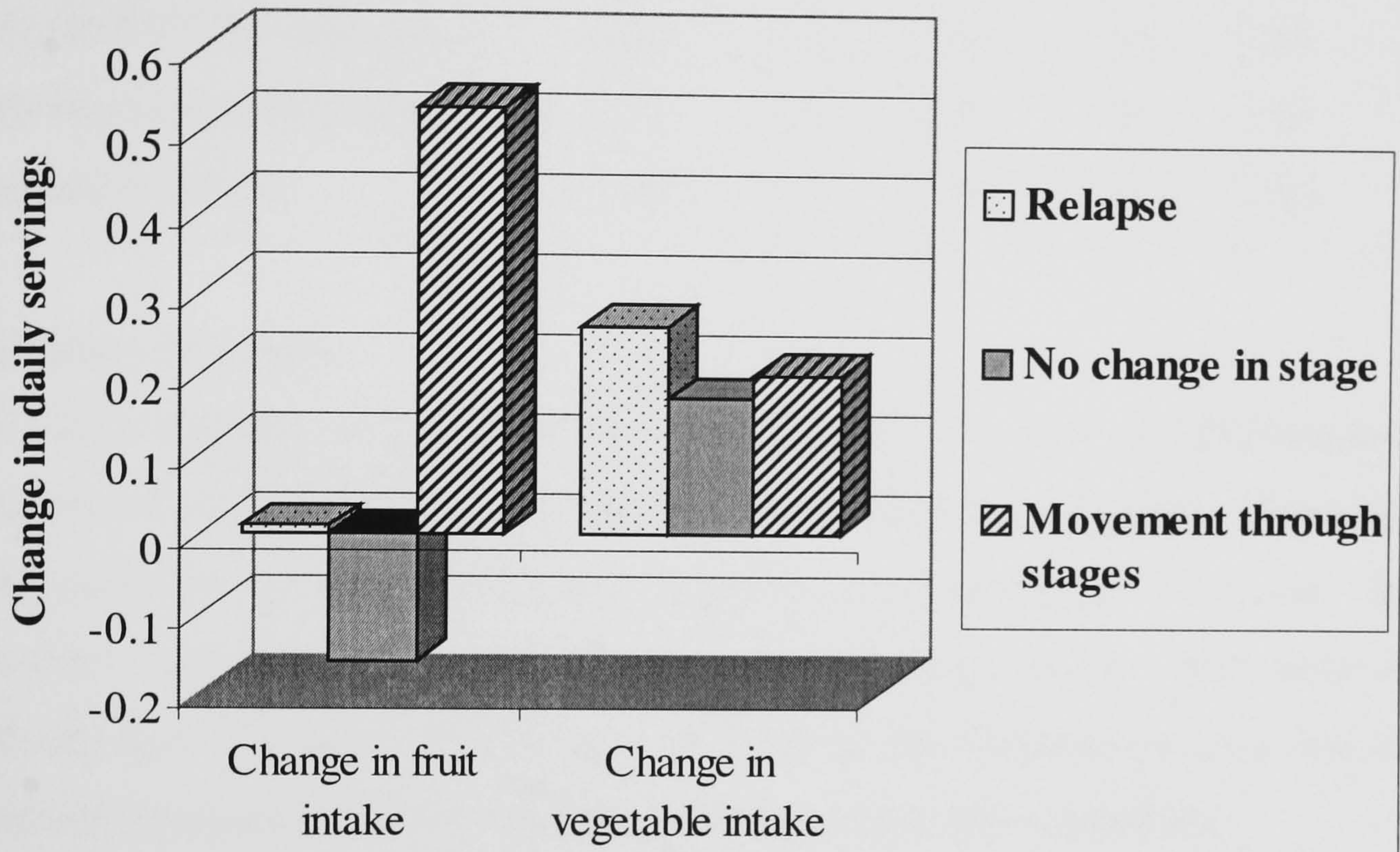


The data were also examined to look at the impact of acquisition of knowledge about the association between diet and disease and consumption in the tailored and general intervention group. Three groups were identified; no knowledge before of after the intervention (no change), knowledge before and after the intervention (no change) and no knowledge before but knowledge after the intervention (change). However there were no differences in changes to intake by group for either the tailored intervention group (ANOVA df[2,152], F= 1.58, ns) or the general intervention group (F [2, 154], = 0.39, ns).

Using a composite score for changes in attitudes to fruit and vegetables, there were no significant correlations between changes in attitudes and changes in intake.

Changes in intake were examined by change in stages of change (e.g. movement through the stages) in the tailored intervention group. Participants were categorised as those who had relapsed (e.g. intention to no intention), those who made no change or those who had progressed along the stages of change (intention to action). The results indicate that there were significant differences in change to fruit intake by change in stages of change (Anova df[2, 144], = 3.42, $p<0.05$). Participants who made a positive change in their stages of change made larger increases in fruit intake. For example participants who had no intention to increase intake prior to the intervention but did intend after the intervention made greater changes to intake than participants who intended to change before and still intended to change after the intervention. However there were no significant differences in changes to vegetable intake by changes in stages of change (Anova df[2, 140], = 0.04, ns) as illustrated in Figure 6.

Figure 6 Change in intake by changes in stage of change for fruit and vegetables



Demographic influences on responses to the intervention

These were examined using changes in intake levels as the main dependent variable. Using a MANOVA there were no significant differences in changes in fruit and vegetable intake, by gender, economic deprivation, highest achieved education level or age. There were also no effects of gender, deprivation, education or age on knowledge. There were however differences in change of vegetable intake dependent on frequency of visits to the dentist with participants who attended most frequently (once every 6 months) increasing their intake the most ($F= 3.16$ [df 3, 470), $p<0.05$).

Features of the leaflet

All three groups were asked about the importance of particular features of a dietary leaflet. There were no differences in ratings of any features apart from personalisation. More participants in the 'tailored group' rated personalisation as higher than the other 2 groups ($\chi^2 = 20.82$, df[4], $p<0.01$). Tips on how to eat healthily and information on diet and health were rated the most important for all three groups. See Table 26.

Table 26 Rating for very important features of a leaflet by intervention group						
	Tailored		General		Control	
	n	%	n	%	n	%
Tips on how to eat healthily	99	65	98	63	94	58
Easy to read	88	57	86	56	78	48
Information on serving sizes	57	37	61	40	56	35
Personalised for each person	48	31	20	13	33	20
Information on diet and health	96	62	90	58	91	56
Printed in colour	20	13	19	12	20	12

Summary of results

The data analyses were replicated from Study 1 to look at differences between participants in the control group and the tailored intervention group. There were found to be increases in intake of fruit and vegetables between groups over time. As well as this there were also increases in the nutrition knowledge items, which were associated with changes in intake. The changes in some of the attitudes for fruit and vegetables were not associated with the changes in intake of fruit and vegetables.

When the data was examined to look at differences between the control group and the general intervention group there were improvements in the nutrition knowledge factors although there were no differences in intake.

The results indicate that the tailored intervention was successful in dietary change and knowledge change, whilst the general intervention was useful for changes to knowledge only. Changes to intake were associated with increases in nutritional knowledge and also positive movement through the stages of change. It can be concluded that a tailored intervention is a useful tool in changing psychological and behavioural factors.

Discussion

This chapter looks at the efficacy of a tailored intervention for increasing fruit and vegetable intake, improving nutritional knowledge levels and changing negative attitudes to fruit and vegetables. In the previous study the tailored intervention was compared simply with no intervention to see if there was any effect worth 'unpacking'. Using a selected sample we were able to show positive effects on knowledge, attitudes and behaviour. However two of the issues which may have affected the interpretation of results from this study were the type of sample used and also the lack of a comparison intervention group. Therefore a different sample was selected to be more representative of the general population derived from dental clinics. Additionally another experimental group was included in the study to compare the tailored intervention with a general intervention (i.e. the same for everybody). This was done to test whether the effort of tailoring an intervention relative to the ease of providing a general intervention, was worthwhile.

Previous research has been inconclusive about the efficacy of tailored intervention for changing fruit and vegetable intake, although the results are more positive for reducing fat intake (Campbell et al, 1994; Brug et al, 1996). Most of the studies have compared a general with a tailored intervention but have no control group (Brug et al, 1996; Marcus et al, 1998). While this shows that one intervention may be better than another it does not take account of the natural changes in dietary behaviour which may be occurring or the effect of the general intervention on behaviour. The only published study which has chosen to use a three group design was that by Campbell et al (1994). In this study there were changes to fat intake as a result of the tailored intervention, but no significant changes to fruit and vegetables as a results of the tailored intervention compared to either the general intervention or no intervention.

Participants in the present intervention study were recruited at dental clinics throughout London. Approximately 50% of the total sample who completed baseline questionnaires about diet at dental clinics volunteered to have more diet information and contributed the study participants. There were no differences in intake levels or nutritional knowledge between participants who wanted more information or those who did not.

There was a reasonable response rate at follow-up (56%) although it was considerably lower than that in the cancer screening setting (86%). It is likely that the dental response rates are more similar to what could be expected in settings other than a research-based screening clinic. Responders in all of the three experimental groups tended to be older and had lower deprivation levels than non-responders. This means that we can not be sure about the behaviour of younger participants or participants with lower SES, as a result of the intervention. Responders also consumed significantly more servings of fruit and vegetables than non-responders at baseline, and interpretations of the intervention effects need to take into consideration these discrepancies.

The dental clinic as a setting showed reasonable value as a venue to recruit participants to dietary interventions. Those participants who valued their health more and had more control over their eating behaviour were more interested in having more information. This suggests that people who need to make changes most and may be less likely to take part in such studies. Different ways of encouraging people to take part should be considered. Offering information on healthy diets may not be seen as entirely relevant to people attending for dental care even though diet is one of the most important characteristics of good dental health. Therefore presenting the information in a more appealing manner by focusing on the benefits to dental health may result in a greater uptake of information.

Baseline results showed that this group of participants had low levels of intake and poor nutritional knowledge making them ideal to take part in such an intervention study. As before, the tailored intervention focused on knowledge and attitudes as these have been found to be associated with intake of fruit and vegetables. In addition the intervention was also tailored to participant's stage of change to encourage intention to change behaviour and behaviour change maintenance. The general intervention covered items on nutritional knowledge and general negative attitudes. The general intervention looked similar to and gave a similar level of information by content and readability to the tailored version. The differences being that individual levels of knowledge, attitudes and stages of change were not taken into consideration.

It was important to see whether participants had increased their knowledge, had more positive attitudes, more intention to change behaviour, and increased their fruit and vegetable intake. For these purposes, comparisons were made between all three groups and also between pairs of experimental groups. The tailored intervention group significantly improved their knowledge about estimations of recommended servings in comparison to the other two groups, although there were no differences in overall knowledge between the two intervention groups. There were found to be increases in knowledge about recommendations and also about the association between fruit and vegetable intake and disease for both of the intervention groups. More people from the tailored intervention group were aware of the 5 a day message at follow-up than the other two groups. When asked about specific diseases more participants from the tailored intervention group were aware of the link between both cancer and heart disease. Whilst both the general intervention and the tailored intervention were successful at increasing knowledge, the tailored intervention had greater effect on knowledge levels. However even the control group improved in knowledge during the intervention period suggesting that there were other external factors influencing knowledge levels. This was also found in the earlier study and may be the result of participants seeking out more information about diet as a consequence of filling in the baseline questionnaire.

Unfortunately there were no changes to attitudes as a result of either intervention although the tailored intervention group were more positive about the price and ease of storage of fruit and follow-up. The intervention design was altered from the first study due to the additional attitude factors included. In the first intervention study participants received information relevant to all negative attitudes with a maximum of 6 attitudes dealt with. However in this study there were now 11 attitudinal factors addressed so it was decided to limit the information given. This meant that participants only received attitude information relevant to the two most negative attitude factors individually rated. As a result of this, the majority of people would have received information on ease of storage and price as these were rated the lowest. This does not give us any indication of why participants generally did not improve attitudes. However it is likely that trying to change attitudes is more difficult to achieve than knowledge change as was found in the first study. Alternatively attitude change is something which does not happen in the short term or as a result of one off mailings. Repeated exposure to information addressing negative attitudes might have a better impact.

The results also showed that people who received the tailored intervention were more likely to intend to increase intake. This is encouraging to see, whether or not this translates immediately to actual behaviour change or not, since it indicates that people are more likely to think about change after receiving the tailored intervention.

As before, the main outcome measure was change to fruit and vegetable intake. Comparison between the three groups showed that there were significant changes to total fruit and vegetables intake in the tailored group, whilst the general intervention group and the control group showed no changes to either fruit or vegetable intake. There was found to be a significant interaction between groups over time indicating a positive effect of tailoring over the general or no intervention groups. Whilst these results are encouraging they are not as impressive as in the first study. Nevertheless the indications are that a tailored intervention can successfully change fruit and vegetable intake more so than that of a general intervention. The lower levels of change could possibly be as a result of the poorer response rate or respondent differences to be discussed later on.

Even though there were increases in nutritional knowledge in both the general and the tailored intervention groups, only in the tailored intervention groups were these increases associated with increases in fruit and vegetable intake. Again it was the acquisition of knowledge about recommended levels that was most closely related to change in behaviour. Knowledge of associations between diet and disease did not relate to changes in behaviour. Therefore although people receiving the general intervention became more knowledgeable, they did not change their behaviour.

The greater efficacy of tailoring may result form people thinking the information on recommendations was personally relevant to them (e.g. I should eat five a day) whilst the general group realised that the recommended levels was five a day but did not think it applied to them (e.g. people should eat five a day). This could be one of the reasons why large scale dietary campaigns do not have an impact on behaviour. Unless personal relevance is placed on these messages, then people may take in the information but not act on it. Disappointingly, attitude change was not found to be associated with intake change which could be because of the lack of change in attitudes. Therefore the results do not offer evidence as to the role attitudes play in behaviour change.

Dental clinics are an interesting setting to consider for dietary intervention studies. They have been previously used for smoking cessation advice (Andrews et al, 1999) and also to give information about cancer risk via computer (Peterson et al, 1992). More work needs to be done to see how dietary advice can be incorporated into the advice already given at dental clinics to see whether this would have a stronger effect on behaviour. One option would be to use computer technology to administer tailored advice whilst people are at the clinic. Perhaps the fact that people were given the interventions after the dental visit meant that they were less salient to them than if they had been given in the dental setting.

Although care was taken to ensure that some of the methodological issues that arose in the previous study were dealt with, there are still threats to the validity of the results. The major problems in interpreting the results of this study are issues around participation and response rates.

One of the factors which differentiated this study from the first intervention study was the lower participation rate. People with higher education were more likely to want to take part in the intervention and somewhat surprisingly also participants with lower socio economic level also wanted to take part in the study. This seems somewhat contradictory as these two factors are usually closely associated. One of the reasons why this did occur could be to do with the nature of the sample, with more professional people who were not home owners or car owners taking part which is characteristic of London and not of normal deprivation indicators. However there were no differences in intake levels between participants and non-participants which is encouraging. This indicates that enrolling participants for intervention studies in this way does not exclude those people who may be in most need of change. Most studies either by choice or by self-selected responders contain participants who are well educated and have lower deprivation levels. The fact that only 50% of the sample were interested in taking part means that other settings may need to be used in order to get a higher enrolment. However if it is a case of getting less people to take part, but more people who need to change their behaviour then logically using stratified samples is justifiable.

Additionally it is important to consider the lower response rates (56%) to the follow-up questionnaire which may affect interpretation of the results. One of the possible reasons for this was the length of time between intervention administration and follow-up data collection. Due to problems in recruiting numbers of participants to take part in the intervention study, it was a number of months between baseline and follow-up data collection. There is some variability in response rates for other tailored intervention studies with numbers ranging between 60% and 90% depending on setting and sample (Dijkstra et al, 1998, Campbell et al, 1994; Brug et al, 1999). Nevertheless the total numbers taking part in this study were large enough to show significant differences at 84% power (post hoc calculations).

The differences in behavioural measures and demographic characteristics mean that the results found at follow-up may not be representative of changes in the total dental sample. Nevertheless, results from an 'intention to treat' analysis still showed significant changes to total fruit and vegetable intake. Therefore it can be concluded that the intervention effects were not as a result of responders selecting themselves into the follow-up.

The results from this intervention study appear not to be as conclusive as the previous study. Although significant differences were found in behavioural and psychological factors as a result of the tailored intervention these appear to be small. The indications are that a tailored intervention can be useful for changing behaviour and knowledge, and more so than a general intervention. However the general intervention may be a useful tool for changing knowledge alone and should not be dismissed. Unfortunately there were no changes to attitudes and the indications from analysis are that attempts to change attitudes did not have significant impact on behaviour.

The associations between knowledge changes and stages of change movement with behaviour change are encouraging. These indicate that if interventions can improve knowledge and change people's intentions to change, then behaviour change is likely to occur. It was possible to show the efficacy of this form of intervention in a more representative sample although the results are not as impressive as one would hope for. Nevertheless it can be concluded that tailoring interventions does have a valuable place in behavioural change work, and worth studying in more detail in order to improve on their efficacy.

Chapter 9 Comparison of intervention data across two groups attending for health check-ups

Introduction

This chapter combines the data from participants in the cancer screening clinics and dental clinics. Participants from both settings were given a tailored intervention aimed at increasing intake of fruit and vegetable and raising nutritional knowledge.

As a selected sub sample of the population, attendees at cancer screening clinics would be expected to differ from the normal population. They were all older adults and by attending clinics they have already shown an heightened interest in health which suggests that they may be more motivated to change their behaviours in relation to their health. They had also already completed a variety of questionnaires and had shown their willingness to come for a medical examination.

In contrast, the dental clinic sample covered a wider age span, and possibly represented a wider cross section of the population (as measured by SES levels) although they were still probably more interested in their health than the population as a whole. These individuals were either routinely attending dental clinics for check ups or having some treatment on their teeth.

Results from the intervention study in the cancer screening clinic looked more positive than the results from the dental clinics. The aim of this chapter is to examine whether the tailored intervention had a significantly different impact in the two samples used or whether the results are consistent with the same general size of effect. The fruit and vegetable intervention might be seen as more relevant to people in a screening clinic especially as bowel cancer prevention involves fruit and vegetables. Therefore one would predict a better effect in this sample.

Method

Data from the tailored intervention and control groups have been collated across the two samples (excluding the general intervention group for these analyses). Participants from the cancer screening clinics and from the dental participants were recruited to take part in the intervention whilst attending the relevant clinics for appointments. They both received a tailored intervention or no intervention (control group) in March of 1998 and 1999 respectively. Follow-up questionnaires were mailed out to all intervention participants at 6 weeks after the intervention.

Results

Characteristics of sample

Altogether there were 964 participants (484 tailored intervention and 480 control) completed follow-ups in the intervention studies, 642 from the cancer screening clinics and 322 from dental clinics. Characteristics of the 2 groups are shown in Table 1. In the cancer screening group there were more men ($\chi^2 = 10.18$, df[1], $p<0.01$), participants had lower educational levels ($\chi^2 = 122.15$, df[4], $p<0.001$), and lower levels of economic deprivation as indexed by car ownership and housing tenure ($\chi^2 = 62.86$, df[2], $p<0.001$), than in the dental sample.

Table 1 Demographic characteristics of cancer screening and dental samples

	Cancer screening n=642		Dental n=322	
	n	%	n	%
Gender				
Men	304	47	118	36
Women	338	53	204	64
Qualification				
Primary	27	4	11	4
Secondary	377	60	108	34
Trade	101	16	36	11
Diploma	65	10	38	12
Degree	63	10	124	39
Economic deprivation				
High	37	6	44	15
Medium	83	13	81	28
Low	518	81	162	56

Intervention data

The data were examined to look at differences in changes to fruit and vegetable intake, and nutrition knowledge as a consequence of receiving the tailored intervention between the two sample groups. Confidence intervals have been used to show significant differences between the groups for effect size.

Logistic regressions were conducted to look at the tailored intervention as a predictor of eating 5 a day at follow-up and also of increasing fruit and vegetable intake, in both groups.

In the cancer screening group, those who received the tailored intervention were 2.1 times as likely to eat 5 a day at follow-up than the control group receiving none. In the dental clinic group, participants receiving the tailored intervention were 1.5 times as likely to eat 5 a day at follow-up.

Table 2 Tailored intervention as a predictor of consumption of 5 a day at follow up

	R	**Sig** (one tailed)	**Odds ratio** *(Confidence intervals)*
Cancer screening group	0.15	0.000	2.13 [*1.53, 2.95*]
Dental clinic group	0.04	0.05	1.47 [*0.92, 2.35*]

The data were then examined to look at participants who increased their intake at all (see Tables 3 and 4). In the cancer screening group participants receiving the tailored intervention were 2.3 times as likely to have increased fruit intake and 1.9 times as likely to have increased vegetable intake. For the dental clinic group, participants receiving the tailored intervention were 1.5 times as likely to have increased fruit intake (See Table 3) and 1.7 times as likely to have increased vegetable intake (See Table 4).

Table 3 Tailored intervention as a predictor of increasing fruit intake at follow up

	R	**Sig** (one tailed)	**Odds ratio** *(Confidence intervals)*
Cancer screening group	0.17	0.000	2.32 [*1.68, 3.21*]
Dental clinic group	0.05	0.045	1.51 [*0.93, 2.43*]

Table 4 Tailored intervention as a predictor of increasing vegetable intake at follow up

	R	Sig (one tailed)	Odds ratio *(Confidence intervals)*
Cancer screening group	0.12	0.000	1.87 [*1.36, 2.57*]
Dental clinic group	0.08	0.015	1.69 [*1.05, 2.74*]

The overlapping confidence intervals indicate that both groups made comparable changes for consumption of 5 a day and an increase in fruit and vegetable intake.

Increases in intake

Analysis of variance was used to look at the effects of study group, intervention group and also the interaction effect of both, on increase levels of fruit and vegetables. There was found to be an effect on increase to intake of fruit by study group ($F= 20.12$, $p< 0.01$) and by intervention group ($F= 19.33$, $p<0.01$). The cancer screening group as a whole increased their fruit intake by 0.42 servings compared to 0.03 servings in the dental group, while the tailored group increased fruit intake by 0.50 servings compared to 0.08 in the control group. There was also an increase to intake of vegetables by study group ($F= 12.63$, $p<0.01$) and by intervention group ($F=17.23$, $p<0.01$). Cancer screening participants increased vegetable intake by 0.34 servings compared to 0.06 servings in the dental group, while tailored participants increased vegetable intake by 0.42 servings compared to 0.07 servings in the control group. There was however there was no interaction between study group and intervention group for increases in intake of fruit ($F=2.11$, ns) or vegetables ($F= 1.01$, ns), confirming the results above.

Nutritional knowledge

There were significant differences in increases of knowledge about recommended servings between the intervention (0.85) and control group (0.15) ($F= 28.96$, $p<0.01$), however there were no differences by study group (dental group = 0.53 and cancer screening group = 0.49) ($F= 0.17$, ns) nor any interaction between intervention group and study group ($F=0.58$, ns).

Summary of results

The tailored intervention was found to have an impact on behaviour of participants in both studies. The cancer-screening group as a whole made greater increases to fruit and vegetables, although there were no differences in changes of knowledge between the groups. Using a tailored intervention significantly increases the chances of eating 5 a day at follow-up in both groups and also for increasing both fruit and vegetables. Both intervention and setting were found to be significantly associated with greater increases to intake of fruit and vegetables. Although the cancer-screening group made greater behavioural changes, there was no interaction between intervention and study group on increases to fruit or vegetable intake, or nutritional knowledge. Therefore the impact of tailoring is similar for intake and knowledge regardless of study group.

Discussion

The purpose of this chapter was to look at possible differences in the impact of a tailored intervention in a cancer screening clinic group and a dental clinic group. Application of a tailored intervention showed positive results for changes to knowledge and fruit and vegetable intake in two quite different medical settings. However the results on the impact of a tailored intervention compared to no intervention on intake levels appeared to be much more impressive for cancer screening participants.

It has already been suggested that people in cancer screening clinics were more concerned about health than dental attendees, and consequently more ready and motivated to change their behaviour. The changes in both the control and intervention group suggest that attendance at a clinic for health screening and completion of a questionnaire on diet may have been sufficient motivation to make dietary changes conducive with reducing cancer risk.

Despite the differences in effect size, the lack of interaction between study group and intervention group show the efficacy of a tailored intervention was no different for either group who received the intervention. Targeting people who are motivated for change is very useful especially if these groups are in need of change. Consideration needs to be taken about people who are perhaps due to receive screening but do not attend. These groups of people would be equally in need of change but may not be aware of this and also not be as motivated about their health. The value of using a dental setting is that it can be used to target a wider variety of people who may not be thinking about change or ready to change behaviour. Nevertheless it is possible for participants in this group to change their behaviour when information is targeted at them as individuals. The benefits of using a cancer screening setting for giving dietary advice can not be diminished because the sample may be unrepresentative. The ability to achieve significant behavioural changes in a group with lower intake levels is very promising.

Further work is needed to look at the people approached to attend cancer screening clinics but who did not attend, to investigate whether they would react differently to an intervention. As well as this, people were invited to take part in both of these intervention studies which meant participants were likely to be more receptive and motivated. Many intervention studies rely on giving all participants an intervention regardless of whether they made an active choice to take part or not. In this study ethical issues of consent were dealt with by giving participants the choice to take part. Different types of setting are likely to mean that interventions need to be adapted to take into consideration the variety in levels of motivation and interest. Dental clinics and cancer screening clinics both offer a salient opportunity to target people about dietary behaviour change in a more focused way than targeting people at home or at work where issues about health may be less relevant.

Chapter 10 Overall discussion

Basis for research and findings

The aims of this research were twofold i) to investigate the relationship between knowledge, attitudes and behaviour in reference to fruit and vegetable intake, and ii) to test the efficacy of a personalised, tailored intervention designed to increase nutritional knowledge, improve attitudes and change behaviour. The work was based on the assumption that people are consuming insufficient levels of fruit and vegetables, as has been found in numerous previous studies and on the lack of effective interventions to change fruit and vegetable intake. Two different populations were selected to test these hypotheses, one from cancer screening clinics and one from dental clinics.

The growing evidence of a link between fruit and vegetable intake and development of cancer and heart disease has resulted in a dietary target of at least 5 servings of fruit and vegetables a day. The findings from this research confirm that very few people are meeting this target, and average intakes are well below recommended levels. As well as this, the majority of responders are unaware of these recommended levels, or the reasons for eating more fruit and vegetables. The assumption could be made that there is a causal link between levels of knowledge and subsequent behaviour. In the baseline surveys both knowledge and attitudes were significantly correlated with intake. Whilst there is a plethora of research identifying a link between attitudes and behaviour, this is somewhat lacking for nutritional knowledge. This is not only because of a paucity of research but also because many studies have found small and non-significant associations between knowledge and behaviour. However in investigating nutritional knowledge, it has to be appreciated that there are different kinds of knowledge to be measured, and that recommendations and health benefits are only two factors to look at. These two factors seem to be strongly associated with intake of fruit and vegetables in the present samples.

Confirming many other studies, attitudes towards fruit and vegetables were found to have an association with dietary behaviour. As has been found in many studies, attitudes about taste and convenience were the best predictors of fruit and vegetables.

Some models propose that knowledge has its impact on behaviour through attitudes (Knowledge>Attitudes>Behaviour) and not directly. Surprisingly attitudes were not found to mediate the effect of knowledge on behaviour. Both of these factors appeared relevant to changing fruit and vegetable intake. If people are assuming (incorrectly) that their intake is adequate then increasing knowledge could give them the reason to change or possibly motivate them to change. However increased knowledge is unlikely to be sufficient to make people change. This is where attitudes can play an important part because this can be used to give people the tools to change their behaviour. Both knowledge and attitudes need to be addressed independently for them to have an effect on behaviour, and assumptions can not be made that increasing knowledge will lead to more positive attitudes.

One way of testing these ideas further, as well as using them practically, is in intervention studies, whereby trying to change knowledge and attitudes should result in behaviour change. Data from both the baseline studies was used to develop the tailored intervention programmes. These tailored the information to the individual's level of knowledge and attitudes. While tailoring has been widely used in relation to stages of change or attitudes, it has not been used in relation to individual levels of knowledge. The poor levels of knowledge seemed to make them an ideal target, although previously people have all been given the same level of nutritional information. Additionally the stages of change model was used as a component of tailoring for the intervention. Therefore we were looking at people's intentions to change their behaviour and focusing on how we could increase intention through advice. Due to the lack of effect on fruit and vegetable intake in most of the tailored intervention studies which also tend to address fat intake simultaneously, only fruit and vegetables were used as target behaviours.

The tailored intervention was found to be effective for changing knowledge, stages of change and behaviour in both study groups. However there was little change to attitudes as a result of the interventions. Therefore as a tool for behavioural change, the results are positive and suggest that the intervention worked partly through improving people's knowledge. Providing information had both a direct and an indirect effect on behaviour through changes to nutritional knowledge level.

When comparing whether the tailored intervention was more effective than the general intervention, the results were not as impressive. Nevertheless the indications were that a tailored intervention was more effective for behavioural change. The intervention appeared to be more effective in a cancer-screening clinic, although statistically the interaction were not significant.

Much of the work on dietary behaviour change has backed away from using nutritional knowledge as a tool. This is partly due to the low associations found between knowledge and behaviour but also a lack of impact of using knowledge-based interventions in the past. These results show that knowledge and attitudes are associated with behaviour and that using these cognitions to guide intervention studies can have a positive outcome on behaviour. As well as this using a tailored intervention is effective for increasing fruit and vegetable intake and nutritional knowledge, more so than using an intervention which is the same for everybody.

Recommendations

There are several areas which in retrospect could have been improved in the design and execution of these studies. Studies in the future involved in testing these findings would be wise to consider some of the shortcomings discussed before. Due to the type of data collection it was not possible to validate the intake measures used in this study. It could be hypothesised that people who received the intervention were more likely to self-report higher intake because of social desirability. Unfortunately due to limitations of space and time, social desirability was not measured at baseline or follow-up. Most studies of this kind also rely on using self-reported measures of intake without testing for social desirability. However this does not necessarily make this a good way to carry out intervention studies. It is possible that some of the significance shown in intervention studies is a result of participants wanting to appear to comply with recommendations instead of actually achieving behavioural change. Despite this the strong significant changes found as a consequence of the tailored intervention indicate that a pattern of behavioural change did exist.

With the increasing development of biochemical markers, it is likely that measures of fruit and vegetable intake will be able to be validated more easily in the future. Currently biochemical markers require blood samples to be given which are not necessarily feasible in community intervention studies.

As well as the measure of intake, the measures of nutritional knowledge were very specific for fruit and vegetable intake. Therefore we have no idea whether greater general nutritional knowledge is related to this type of dietary behaviour. Also the differences in association levels suggest that some areas of knowledge are more relevant for behaviour than others. Therefore whilst contradicting some of the work which has found poor associations between knowledge and behaviour, the fact that more specific measures were used mean that conclusions can only be drawn in relation to this. There is an assumption of causality between knowledge and behaviour which needs to be validated.

The major limitation came from the samples used. Future studies to test both the associations between cognition and behaviour and the efficacy of tailored interventions would be wise to use more representative samples such as general practice patients. Campbell et al (1994) found a general practice setting feasible for administering a tailored intervention programme even if the results were not conclusive. General practice patients would offer a sample that was not necessarily concerned about their health, although this would only be true if they were targeted in the home. It is important to target participants who are most in need of change. Therefore it may be necessary to stratify samples to take in more men, lower SES and lower educated who tend to consume fewer servings of fruit and vegetables. Alternatively people could be targeted from a younger age to attempt to stop these differences emerging later on. However, although using samples from cancer screening settings may result in people who are more motivated to change their behaviour taking part, this is not necessarily a bad thing. Dietary advice can be co-ordinated with ongoing health promotion to more positive effect than addressing people who may not be receptive to advice, or at least at times when they are less receptive.

Another methodological issue that needs to be addressed is the length and number of follow-ups to evaluate an intervention. The time period used in this study was selected to produce sufficient change in behaviour within the time constraints of carrying out the research. Therefore the conclusions drawn about behaviour change only represent the 6-week follow-up period. Longer follow up periods would tell us whether these changes were sustained and if so, for how long. One-off interventions are likely to suffer from a accelerated diminishing effect compared to longitudinal intervention programmes, therefore proper evaluation of tailored programmes may require following up participants with up-to-date personalised information at different intervals.

The results indicate that tailoring is more successful than general interventions, however this does not tell us what aspects of tailoring worked. It could have been the knowledge, attitudes, stages of change or just because it had the individual's name on it and seemed more personally relevant to them. Therefore research in the future could attempt to find out what aspects of tailoring are more effective. This study tailored the intervention by a number of factors which may have all contributed to the effect, or alternatively perhaps only one was relevant and the others had no impact at all. This would require unpacking the tailoring method to gain a better understanding of how it worked.

Implications

The important factors to draw out of this work can be used to guide approaches to dietary behaviour in the future. In the future there will be a need to incorporate environmental factors such as pricing policy, production issues and availability with individualised treatments similar to that used in this research. There is a tendency for intervention programmes to work on either addressing people's cognitions or addressing possible barriers to change exclusively. However these is no reason to suggest why people can not be targeted for change using both a top down and bottom up approach. Whilst people can be educated about the changes needed to achieve good dietary behaviour, if there are too many barriers in the way then this is unlikely to be achieved.

As well as this, there is an enormous development of information technology which is ideal for these types of programme. This means that interventions can be produced more effectively and can be more closely tailored to the individual's needs, therefore producing the equivalents of one-to-one counselling but without the individual contact required. With the growth in the use of the internet, people can be approached in their own homes at their convenience. Additionally this could mean that people can be given up-to-date information at different time points, taking into account personal changes in behaviour. However the benefits of producing more individually tailored information need to be balanced carefully against information overload.

Once an effective model for behaviour change is achieved then this needs to be tested out in relation to real health outcomes (e.g. incidence of heart disease). Intervention studies are currently used to show the effectiveness of different methods for behavioural change over a relatively short time period. Unfortunately this does not give sufficient information about changes to mortality and morbidity as a result of the interventions.

Although there is a variety of evidence to suggest that fruit and vegetables are linked to cancer and heart disease this is based largely on retrospective cohorts or experimental investigations. What is needed is to see the long-term outcome of interventions, otherwise it will be more and more difficult to justify research which shows only a small behavioural effect.

This leads onto the issue of cost-effectiveness. It is essential to quantify the effectiveness of tailored interventions. Whilst results such as these indicate that tailored interventions are more effective than general interventions, if the additional cost needed to produce these outweighs the effect then their use can not be justified. This can only be achieved through more rigorous evaluation of the efficacy of tailored interventions. Intervention programmes such as these need to be made part of health or public policy and not just as tools for testing out research hypotheses. Establishing the effectiveness of tailored intervention is not the end product. It is necessary to improve dietary behaviour in line with health recommendations. Changing knowledge and attitudes is just one way to achieve these aims.

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APPENDIX 1: *Baseline fruit and vegetable questionnaire (flexiscope sample)*

The ICRF Health Behaviour Unit is carrying out a survey of people's diets. It would be helpful if you could answer this short questionnaire about your consumption of fruit and vegetables.

Please fill it in as honestly as possible. Your answers will be treated with complete confidentiality.

Anna H Baker
ICRF Health Behaviour Unit
University College London
2-16 Torrington Place
London WC1E 6BT
0171 209 6634

Thank you very much for your co-operation

16. Please rate how much you like or dislike the following fruit and vegetables

	Dislike very much	Dislike a bit	Neither like nor dislike	Like a bit	Like very much
Apples	☐	☐	☐	☐	☐
Oranges	☐	☐	☐	☐	☐
Bananas	☐	☐	☐	☐	☐
Tinned fruit	☐	☐	☐	☐	☐
Carrots	☐	☐	☐	☐	☐
Peas	☐	☐	☐	☐	☐
Tomatoes	☐	☐	☐	☐	☐
Green leafy vegetables	☐	☐	☐	☐	☐

17. These questions ask you about your own health at the moment

	Much lower	Lower	The same	Higher	Much higher
Compared to someone of your age & sex, do you think your chances of getting cancer are	☐	☐	☐	☐	☐
Compared to someone of your age & sex, do you think your chances of getting heart disease are	☐	☐	☐	☐	☐

18. How many servings of fruit and vegetables (combined) per day do health experts recommend?

______________ *Please guess if you do not know.*

19. How high or low do you think fruit and vegetables are in the following:

		Very low	Low	High	Very high
vitamins	*fruit*	☐	☐	☐	☐
	vegetables	☐	☐	☐	☐
fibre	*fruit*	☐	☐	☐	☐
	vegetables	☐	☐	☐	☐

7. Are you seriously thinking about increasing the amount of vegetables you eat sometime in the next 6 months?

No ☐ *Go to question 8*

Yes ☐ *Go to question 7a*

7a. Are you planning to make this increase sometime in the next month?

Yes ☐ No ☐

8. Have you ever changed your eating habits in the past to increase the amount of vegetables in your diet?

No ☐ *Go to question 9*

Yes ☐ *Go to question 8a.*

8a. Are you still eating more vegetables?

Yes ☐ No ☐

9. How much do you agree with the following statements about vegetables

	Strongly Disagree	Disagree	Agree	Strongly Agree
vegetables make a convenient snack	☐	☐	☐	☐
vegetables taste delicious	☐	☐	☐	☐
vegetables are expensive	☐	☐	☐	☐
vegetables don't keep very well	☐	☐	☐	☐
vegetables are easy to cook	☐	☐	☐	☐
good vegetables can be bought at my local shops	☐	☐	☐	☐

10. How much do you agree with the following statements about fruit

	Strongly Disagree	Disagree	Agree	Strongly Agree
fruit makes a convenient snack	☐	☐	☐	☐
fruit tastes delicious	☐	☐	☐	☐
fruit is expensive	☐	☐	☐	☐
fruit is easy to prepare	☐	☐	☐	☐
fruit doesn't keep very well	☐	☐	☐	☐
good fruit can be bought at my local shops	☐	☐	☐	☐

PLEASE CHECK THAT YOU HAVE ANSWERED EVERY QUESTION BEFORE TURNING OVER

The University College London Hospitals

St. Martin's House,
140 Tottenham Court Road, London W1P 9LN

Telephone: 0171 380...................

Telephone: 0171 387 9300 Ext: ....

Fax: ....

The Joint UCL/UCLH Committees on the Ethics of Human Research

Committee A Chairman: Dr F D Thompson

Please address all correspondence to:
Mrs Iwona Nowicka
Research & Development Directorate
9th Floor, St Martin's House
140 Tottenham Court Road, LONDON W1P 9LN
Tel. 0171- 380 9579 Fax 0171-380 9937

Professor J Wardle
Director of Health Behaviour Unit
Health Behaviour Unit
Department of Epidemiology and Public Health
UCL
2-16 Torrington Place

11 March 1997

Dear Professor Wardle

Study No: 97/0119*(Please quote in all correspondence)*
Title: **The role of nutritional knowledge on the intake of fruit and vegetables: Can knowledge change behaviour? (An intervention study)**

I have reviewed your application and have given it Chairman's Approval. You may therefore commence your study.

Please note that it is important that you notify the Committee of any adverse events or changes (name of investigator etc) relating to this project. You should also notify the Committee on completion of the project, or indeed if the project is abandoned. **Please remember to quote the above number in any correspondence.**

Yours sincerely

pp.

Dr F D Thompson
Chairman

APPENDIX 3: *Message feedback file*

Statements for personalised interventions

Intro.
We have now analysed your results from the eating questionnaire you completed at the cancer screening clinic Mr Blair. Based on what you said, we have designed this leaflet especially for you. This leaflet tells you about the benefits of eating more fruit and vegetables. It also gives you some suggestions about how you can do this.

How much fruit and vegetables do you eat?

Your results show that you eat 1 serving of fruit a week and 3 servings of vegetables a week.

Stage of change statements

This means that most of the time Mr Blair, you are not quite eating the recommended amount of fruit and vegetables per day.

Precontemplation
You said you are not planning to increase the amount of fruit and vegetables you eat. It is important that you rethink this Mr Blair. We hope that this leaflet will give you some ideas about why fruit and vegetables are important.

Contemplation
You said you are planning to increase the amount of fruit and vegetables you eat in the next month. This is a very good idea Mr Blair. We hope that this leaflet will give you some ideas about why fruit and vegetables are important.

Action
You said you have already increased the amount of fruit and vegetables you eat to at least 4 servings a day. Well done, keep it up Mr Blair. It is important to keep on eating at least 5 servings of fruit and vegetables daily and not let it slip. We hope that this leaflet will give you some ideas about why fruit and vegetables are important.
Although you have increased your intake in the past, you are not quite eating the recommended level of at least five servings of fruit and vegetables a day. We would like you to think about increasing the amount of fruit and vegetables you eat again. You need to aim for at least five servings a day Mr Blair. We hope that this leaflet will give you some ideas about why fruit and vegetables are important.

Health recommendations
You said you thought health experts recommend 3 servings of fruit and vegetables a day. In fact the new recommendation is that people should eat at least 5 servings of fruit and vegetables a day.

You said you thought health experts recommend 5 servings of fruit and vegetables a day. This is correct. The new recommendation is that people should eat at least 5 servings of fruit and vegetables a day.

We recommend you increase the amount of fruit you eat by 2 servings a day; and the amount of vegetables you eat by 1 serving a day.

We recommend that you carry on eating the amount of fruit and vegetables you already eat, and try not to let this slip.

Why should you eat more fruit and vegetables Mr Blair?

You may not know that it has been found that fruit and vegetables are protective against cancer and heart disease. If you increase the amount of fruit and vegetables you eat, you will help decrease your risk of getting cancer or heart disease.

Fruit and vegetables are very good for you. They contain a variety of mineral and vitamins such as:
Beta-carotene.
Vitamin A, B, C, and E.
Selenium.
Fibre.
These are all good for your body and your long-term health.

Fruit and vegetable also contain antioxidants. These help protect your body cells from damage by attacking 'free radicals' that can harm cells.

Fruit and vegetable are low in calories but high in important nutrients, which improve the overall quality of your diet.

How can you increase the amount of fruit and vegetables in your diet?
Fruit
Plan ahead.
Eat fruit instead of sugary snacks or desserts.
Always keep the fruit bowl stocked up with some fruit.
Keep plenty of tinned fruit at home.
Have a glass of fresh orange juice every day.

Please tick if you manage to do any of the above in the next week.

Vegetables
Have an extra serving of vegetable with your main meal.
Have some salad with your lunch or put extra salad in your sandwiches.
Use plenty of vegetables to make stews, soups or stir-frys.
Have raw vegetables such as carrots, celery or peppers as a snack.

Please tick if you manage to do any of the above in the next week.

What do you think about fruit and vegetables Mr Blair?

Attitudes
You were very positive about fruit Mr Blair. This is good because we agree with you. Fruit is an important part of your diet.

"fruit isn't easy to prepare"

Fruit is very easy to prepare. Most fruits only need to be washed or peeled before eaten. Fruits such as apples, rhubarb and blackberries are good for making purees and crumbles. A fruit salad can be prepared quickly by chopping up raw fruit, and you can vary the ingredients by adding some tinned fruit.

"fruit doesn't keep very well"
We think you'll find fruit keeps better when stored properly. Don't leave fruit in direct sunlight. Keep it in a cool spot or even in the fridge. Also remember not to pile fruits on top of one another. This will avoid them bruising or going bad. Tinned and dried fruit also count as part of your daily servings. After opening tins of fruit, remember to keep the fruit in the fridge.

"fruit is expensive"
Fruit can work out cheaper than snacking alternatives. Look out for special offers at your local shops and supermarkets. Tinned fruit in natural juice, a glass of pure fruit juice or dried fruit also count as part of your daily servings.

“good fruit can't be bought in shops close to where I live"
Fruit does not need to be fresh every time. Tinned and dried fruit count as part of your daily servings. Take time to stock up with fruit if you are near a supermarket or greengrocers shop.

"fruit doesn't make a convenient snack"
Fruit such as bananas, apples or grapes are easy to eat and prepare. You can eat fruit instead of sugary and fatty snacks such as biscuits and chocolate.

"fruit doesn't taste very nice"
There are lots of different kinds of fruit available at your local shops and supermarkets. Try something new if you don't like any of the more common ones. You can also eat tinned fruit with natural juice as part of you intake.

You were very positive about vegetables Mr Blair. This is good because we agree with you. Vegetables should be are an important part of your diet.

"vegetables aren't easy to cook"
Some vegetables are easy to cook. It is true that most vegetables need to be washed or peeled, but then they can be easily boiled, steamed, or roasted. Remember frying or roasting vegetables increase the fat, so only do so occasionally. Use vegetables in soups or stews to add flavour! Many vegetables like carrots and peppers taste good when you eat them raw. Tinned or frozen vegetables are a good alternative if you are in a hurry.

"vegetables don't keep very well"
We think you'll find vegetables are easy to keep when stored properly. Root vegetables should keep for up to 6 days and green vegetables for at least 3 days if they are stored away from direct sunlight in a cool, dry place. Salad items can be stored in the fridge or covered in a cool place. Frozen and tinned vegetables also count as part of your daily servings. After opening tins of vegetables, remember to keep the vegetables in the fridge.

"vegetables are expensive"

Vegetables can work out cheaper than you think. They are a cheap way of filling up and adding variety to your meals. Look out for special and seasonal offers at your local shops and supermarkets.

"good vegetables can't be bought in shops close to where I live"
Vegetables do not need to be fresh every time. Frozen and tinned vegetables also count as part of your daily servings. Take time to stock up on vegetables if you are near a supermarket or greengrocers.

"vegetables don't make a convenient snack"
You can make a quick and easy snack by chopping raw vegetables. Next time you are about to eat fatty snacks like crisps or crackers, consider eating a raw tomato or carrot instead.

"vegetables don't taste very nice"
There are lots of different vegetables available at your local shops and supermarkets. Try something new, if you don't like any of the more common ones. Try mixing them with other things to make them taste different.

Stages of change
It may help if you spend a little time thinking about the amount of fruit and vegetables you are eating at the moment Mr Blair. You should consider the benefits you would get from eating more fruit and vegetables. Good luck!

You know you should eat more fruit and vegetables Mr Blair. It is just a question of how to get going. Think about ways to make it easier to eat more fruit and vegetables. For example, you could have fruit instead of other snacks; you could have an extra serving of vegetable with your main meal. Try to have a bit of salad with your light meals. Good luck!

You say that you are already eating more fruit and vegetables Mr Blair. Get your friends and family to do the same, and that will help you to keep it up. Also plan ahead by keeping some frozen or tinned fruit and vegetables in the house, so you don't run out. Good luck!

A personal program designed for Mr A Blair
A Healthy Diet: 5+ Fruit and Vegetables

We have now analysed your results from the eating questionnaire you completed at the cancer screening clinic <<name>>. Based on what you said, we have designed this leaflet especially for you. This leaflet tells you about the benefits of eating more fruit and vegetables. It also gives you some suggestions on how you can do this.

How much fruit and vegetables do you eat?

Your results show that you eat

<<fruit intake>>	**<<vegetable intake>>**

<<stage of change>>

<<recommendations>>

We recommend 5 or more servings of fruit and vegetable a day

<<intake increases>>

Why should you eat more fruit and vegetables?

You may not know that it has been found that fruit and vegetables are protective against cancer and heart disease. If you increase the amount of fruit and vegetables you eat, you will help decrease your risk of getting cancer or heart disease.

Fruit and vegetables are very good for you. They contain a variety of minerals and vitamins such as:

- Beta-carotene.
- Vitamin A, B, C, and E.
- Selenium.
- Fibre.

These are all good for your body and your long-term health.

- Fruit and vegetables also contain antioxidants. These help protect your body cells from damage by attacking 'free radicals' that can harm cells.

- Fruit and vegetables are low in calories but high in important nutrients, which improve the overall quality of your diet.

How can you increase the amount of fruit and vegetables you eat?

fruit

- Plan ahead.
- Eat fruit instead of sugary snack or desserts.
- Always keep the fruit bowl stocked up with some fruit. ❑
- Keep plenty of tinned fruits at home. ❑
- Have a glass of fresh fruit juice daily. ❑

Please tick if you manage to do any of the above in the next week

vegetables

- Have an extra serving of vegetables with your main meal. ❑
- Have some salad with your lunch or put extra salad in your sandwiches. ❑
- Use vegetables to make stews, soups or stir-fry's. ❑
- Use raw vegetables such as carrots, celery or peppers as a snack. ❑

Please tick if you manage to do any of the above in the next week

Please turn over

We have now analysed your results from the eating questionnaire you completed at the cancer screening clinic Mr Blair. Based on what you said, we have designed this leaflet especially for you. This leaflet tells you about the benefits of eating more fruit and vegetables. It also gives you some suggestions on how you can do this.

How much fruit and vegetables do you eat?

Your results show that you eat

5-6 servings of fruit a week	**5-6 servings of vegetables a week**

This means that most of the time Mr Blair, you are not quite eating the recommended amount of fruit and vegetables. You said you are planning to increase the amount of fruit you eat in the next month. This is a very good idea. You also said you are not planning to increase the amount of vegetables you eat. It is important that you reconsider this. We hope that this leaflet will give you some ideas about why fruit and vegetable are important.
You said you thought health experts recommend 3 servings of fruit and vegetables a day. In fact the new recommendation is that people should eat at least 5 servings of fruit and vegetables a

We recommend 5 or more servings of fruit and vegetable a day

We recommend you increase the amount of fruit you eat by 2-3 servings a day; and the amount of vegetables you eat by 2-3 serving a day.

Why should you eat more fruit and vegetables?

You may not know that it has been found that fruit and vegetables are protective against cancer and heart disease. If you increase the amount of fruit and vegetables you eat, you will help decrease your risk of getting cancer or heart disease.

Fruit and vegetables are very good for you. They contain a variety of minerals and vitamins such as:

- Beta-carotene.
- Vitamin A, B, C, and E.
- Selenium.
- Fibre.

These are all good for your body and your long-term health.

- Fruit and vegetables also contain <u>antioxidants</u>. These help protect your body cells from damage by attacking 'free radicals' that can harm cells.

- Fruit and vegetables are low in calories but high in important nutrients, which improve the overall quality of your diet.

How can you increase the amount of fruit and vegetables you eat?

fruit

- Plan ahead. ☐
- Eat fruit instead of sugary snack or desserts. ☐
- Always keep the fruit bowl stocked up with some fruit. ☐
- Keep plenty of tinned fruits at home. ☐
- Have a glass of fresh fruit juice daily. ☐

Please tick if you manage to do any of the above in the next week

vegetables

- Have an extra serving of vegetables with your main meal. ☐
- Have some salad with your lunch or put extra salad in your sandwiches. ☐
- Use vegetables to make stews, soups or stir-fry's. ☐
- Use raw vegetables such as carrots, celery or peppers as a snack. ☐

Please tick if you manage to do any of the above in the next week

Please turn over

7 March 1998

Dear «title» «last_name»,

Last year, while you were attending an appointment in «Hospital» for the ICRF Flexiscope Trial, you filled in a questionnaire about fruit and vegetables. You said you were interested in receiving information about adopting a healthy diet. We are now pleased to send you a leaflet about fruit and vegetables.

This leaflet has been personalised for you based on the answers you gave in the questionnaire. It tells you how much fruit and vegetables you should be eating, the benefits of eating more fruit and vegetables, and advice on how to go about eating more fruit and vegetables. We hope that you will find this leaflet informative and helpful.

In the next month, we would like to contact you again to ask you what you thought about the leaflet. This will involve us sending you a short questionnaire to fill in.

We are very grateful for your assistance in this study. If you have any questions you would like to ask, please call me on 0171 209 6634.

Thank you very much for reading the leaflet.

Yours sincerely

Anna H. Baker

Anna H Baker
Research Psychologist

APPENDIX 7: *Control group follow-up questionnaire*

FRUIT AND VEGETABLE QUESTIONNAIRE

1. Recently how many servings of fruit have you been eating? *A serving is the equivalent of an apple, orange, banana or a small bowlful of raspberries, strawberries etc. Please tick the appropriate box.*

☐ 0-2 a week ☐ 3-4 a week ☐ 5-6 a week ☐ 1 a day ☐ 2 a day ☐ 3 a day ☐ 4 a day ☐ 5+ a day

2. Recently how many servings of vegetables have you been eating? *A serving is the equivalent of a handful of carrots, a side serving of peas or a small side salad. Do not include potatoes. Please tick the appropriate box.*

☐ 0-2 a week ☐ 3-4 a week ☐ 5-6 a week ☐ 1 a day ☐ 2 a day ☐ 3 a day ☐ 4 a day ☐ 5+ a day

3. Do you think the amount of fruit you eat now is?
☐ Not enough ☐ About right ☐ Too much

4. Do you think the amount of vegetables you eat now is
☐ Not enough ☐ About right ☐ Too much

5. Are you seriously thinking about increasing the amount of fruit you eat sometime in the next 6 months?
☐ No
☐ Yes **If yes, are you plannning to make this increase in the next month?** ☐ Yes ☐ No

6. Have you ever changed your eating habits in the past to increase the amount of fruit in your diet?
☐ No
☐ Yes **If yes, how long ago did you make this change?** ☐☐ *months or* ☐☐ *years*
6a. Are you still eating more fruit than you used to? ☐ Yes ☐ No

7. Are you seriously thinking about increasing the amount of vegetables you eat sometime in the next 6 months
☐ No
☐ Yes **If yes, are you plannning to make this increase in the next month?** ☐ Yes ☐ No

8. Have you ever changed your eating habits in the past to increase the amount of vegetables in your diet?
☐ No
☐ Yes **If yes, how long ago did you make this change?** ☐☐ *months or* ☐☐ *years*
8a. Are you still eating more vegetables than you used to? ☐ Yes ☐ No

9. Do you know of any major health problems or diseases that are related to eating too little fruit and vegetables? ☐ Yes ☐ No
9a. If yes, which disease/s do you think are related to eating too little fruit and vegetables?

Please put one letter in each box and leave a space between each word

10. How many servings of fruit and vegetables (combined) a day do health experts recommend?
☐ *Guess if you do not know*

11. Have you heard of antioxidants? ☐ Yes ☐ No

12. How much of the following do you think fruit contain? *Please tick the appropriate box.*

	Low levels	Average levels	High levels	Don't know
Antioxidants	☐	☐	☐	☐
Vitamins	☐	☐	☐	☐
Fibre	☐	☐	☐	☐
Calories	☐	☐	☐	☐

Please turn over the page

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up follow-up letter

17 April 1998

Dear <<name>>,

Last year, while you were attending an appointment in <<hospital>> for the ICRF Flexiscope Trial, you filled in some questions about fruit and vegetables. You indicated that you would like to receive more information about adopting a healthy diet. To enable us to do this we are asking everybody to fill in another short questionnaire about fruit and vegetables, so we can check your present situation.

It is important that you complete the questions as honestly as possible. Your answers will be treated with complete confidentiality. If there are any comments you wish to add, then please do so at the end. Please return the completed questionnaire as quickly as possible in the FREEPOST envelope supplied, which does not require a stamp.

To thank you for completing the questionnaire, we will enter your name in a prize draw to win Marks & Spencer vouchers. There will be a 1^{st} prize of £50, 2^{nd} prize of £30 and 3^{rd} prize of £15. The winners will be contacted shortly after the draw. We will also be sending out information on adopting a healthy diet within the next few weeks.

We are very grateful for your assistance. The information you give us is useful in finding out more about people's fruit and vegetable consumption. If you have any questions you would like to ask, please call me on 0171 209 6634.

Yours sincerely,

Anna H. Baker

Anna H Baker
Research Psychologist

FRUIT AND VEGETABLE QUESTIONNAIRE

1. Recently how many servings of fruit have you been eating? *A serving is the equivalent of an apple, orange, banana or a small bowlful of raspberries, strawberries etc. Please tick the appropriate box.*

☐ 0-2 a week ☐ 3-4 a week ☐ 5-6 a week ☐ 1 a day ☐ 2 a day ☐ 3 a day ☐ 4 a day ☐ 5+ a day

2. Recently how many servings of vegetables have you been eating? *A serving is the equivalent of a handful of carrots, a side serving of peas or a small side salad.* ***Do not include potatoes.*** *Please tick the appropriate box.*

☐ 0-2 a week ☐ 3-4 a week ☐ 5-6 a week ☐ 1 a day ☐ 2 a day ☐ 3 a day ☐ 4 a day ☐ 5+ a day

3. Do you think the amount of fruit you eat now is?
☐ Not enough ☐ About right ☐ Too much

4. Do you think the amount of vegetables you eat now is?
☐ Not enough ☐ About right ☐ Too much

5. Are you seriously thinking about increasing the amount of fruit you eat sometime in the next 6 months?
☐ No
☐ Yes **If yes, are you plannning to make this increase in the next month?** ☐ Yes ☐ No

6. Have you ever changed your eating habits in the past to increase the amount of fruit in your diet?
☐ No
☐ Yes **If yes, how long ago did you make this change?** ☐☐ *months or* ☐☐ *years*
6a. Are you still eating more fruit than you used to? ☐ Yes ☐ No

7. Are you seriously thinking about increasing the amount of vegetables you eat sometime in the next 6 months?
☐ No
☐ Yes **If yes, are you plannning to make this increase in the next month?** ☐ Yes ☐ No

8. Have you ever changed your eating habits in the past to increase the amount of vegetables in your diet?
☐ No
☐ Yes **If yes, how long ago did you make this change?** ☐☐ *months or* ☐☐ *years*
8a. Are you still eating more vegetables than you used to? ☐ Yes ☐ No

9. Do you know of any major health problems or diseases that are related to eating too little fruit and vegetables? ☐ Yes ☐ No
9a. If yes, which disease/s do you think are related to eating too little fruit and vegetables?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Please put one letter in each box and leave a space between each word

10. How many servings of fruit and vegetables (combined) a day do health experts recommend?
☐ *Guess if you do not know*

11. Have you heard of antioxidants? ☐ Yes ☐ No

12. How much of the following do you think fruit contain? *Please tick the appropriate box.*

	Low levels	Average levels	High levels	Don't know
Antioxidants	☐	☐	☐	☐
Vitamins	☐	☐	☐	☐
Fibre	☐	☐	☐	☐
Calories	☐	☐	☐	☐

Please turn over the page

10880

APPENDIX 10: ***Intervention group follow-up letter***

17 April 1998

Dear <<name>>,

You were recently sent a personalised leaflet about eating fruit and vegetables. We are now sending everybody a short questionnaire about the leaflet to complete. If by any chance you did not receive the leaflet, then please call me and I will send one to you immediately.

It is important that you complete the questions as honestly as possible. Your answers will be treated with complete confidentiality. If there are any comments you wish to add, then please do so at the end. Please return the completed questionnaire as quickly as possible in the FREEPOST envelope supplied, which does not require a stamp.

To thank you for completing the questionnaire, we will enter your name in a prize draw to win Marks & Spencer vouchers. There will be a 1st prize of £50, 2nd prize of £30 and 3rd prize of £15. The winners will be contacted shortly after the draw.

We are very grateful for your assistance. The information you give us will be very useful in helping us to design dietary advice. If you have any questions you would like to ask, please call me on 0171 209 6634.

Yours sincerely,

Anna H. Baker

Anna H Baker
Research Psychologist

APPENDIX 11: ***Reminder letter***

11 May 1998

Dear <<name>>,

Fruit and vegetable questionnaire

A few weeks ago, I wrote to you asking you to fill in a questionnaire on fruit and vegetables. I do not appear to have received your questionnaire as yet. Your questionnaire is important to us, so I am sending you a reminder.

I would like to remind you that everybody who completes the questionnaire will be entered into a prize draw to receive Marks and Spencer vouchers up to the value of £50. The winners will be contacted shortly after the draw.

I would be very grateful if you could complete the questionnaire enclosed as soon as possible and return it in the FREEPOST envelope provided. I am very grateful for your help in this research. Your answers will be very useful in helping us find out more about people's fruit and vegetable consumption. If you have any questions you would like to ask, please cal me on 0171 209 6634.

If you have already sent your reply, thank you for your help.

Yours sincerely,

Anna H. Baker

Anna H Baker
Research Psychologist

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APPENDIX 12: *Baseline fruit and vegetable questionnaire (dental sample)*

EATING SURVEY

The Health Behaviour Unit at University College London is carrying out a survey of people's diets. This is being done in a number of dental clinics in London.

It would be helpful if you could answer this questionnaire about fruit and vegetables. This will take between 5 and 10 minutes to complete.

Please fill it in as honestly as possible. It is important that you answer every question. Your answers will be treated with complete confidentiality.

Anna H Baker
Health Behaviour Unit
University College London
2-16 Torrington Place
London WC1E 6BT
0171 209 6634

Thank you very much for completing this questionnaire. If you have anything you wish to add then please do so below.

We would now like you to answer the same questions about fruit

11. How much do you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Agree	Strongly Agree
fruit makes a convenient snack	☐	☐	☐	☐
fruit tastes delicious	☐	☐	☐	☐
fruit is expensive	☐	☐	☐	☐
fruit doesn't keep very well	☐	☐	☐	☐
fruit is not filling	☐	☐	☐	☐
good fruit can be bought locally	☐	☐	☐	☐
fruit is good for weight control	☐	☐	☐	☐
fruit is bad for you	☐	☐	☐	☐
fruit is healthy	☐	☐	☐	☐
fruit takes a long time to prepare	☐	☐	☐	☐
fruit is difficult to carry around	☐	☐	☐	☐
Eating lots of fruit decreases my chance of developing heart disease	☐	☐	☐	☐
Eating lots of fruit reduces my chances of getting cancer in later life	☐	☐	☐	☐

12. How much do you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Agree	Strongly Agree
There are few things more important than good health	☐	☐	☐	☐
If you don't have your health you don't have anything	☐	☐	☐	☐
If I take the right actions, I can stay healthy	☐	☐	☐	☐
I am in control of my health	☐	☐	☐	☐

13. How much do you agree or disagree with the following:

	Strongly disagree	Disagree	Agree	Strongly agree
My friends and family eat more vegetables than I do	☐	☐	☐	☐
My friends and family eat more fruit than I do	☐	☐	☐	☐

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14. How confident are you that you can do the following...

	Definitely cannot do	Probably cannot do	Probably can do	Definitely can do
Usually choose fruit for dessert	☐	☐	☐	☐
Have more than one serving of vegetables with your meal	☐	☐	☐	☐
Always keep some fruit in the house	☐	☐	☐	☐
Eat raw vegetables for snacks instead, of crackers or crisp	☐	☐	☐	☐
Have vegetables or a salad with both lunch and dinner	☐	☐	☐	☐
Eat fruit for snacks instead of sweets or cakes	☐	☐	☐	☐

15. Please rate how much you like or dislike the following:

	Dislike very much	Dislike a bit	Neither like nor dislike	Like a bit	Like very much
Fruit *(in general)*	☐	☐	☐	☐	☐
Vegetables *(in general)*	☐	☐	☐	☐	☐
Salads	☐	☐	☐	☐	☐

PLEASE CHECK THAT YOU HAVE ANSWERED EVERY QUESTION BEFORE TURNING OVER

APPENDIX 13: ***Message feedback file***

Statements for dental intervention

Stage of change statements

It is important that you think about eating more fruit and vegetables if you are not doing so already. At the moment you are not eating the recommended levels of fruit and vegetables. This leaflet will give you some ideas about why fruit and vegetables are so important and how you can eat more.

It is very important that you start to eat more fruit and vegetables and good that you are planning to do so. At the moment you are not eating the recommended levels of fruit and vegetables. This leaflet will give you some ideas about why fruit and vegetables are so important and how you can eat more.

You have already increased the amount of fruit and vegetables you eat, to at least 5 servings a day. Well done, keep it up. It is important to keep on eating at least 5 servings of fruit and vegetables daily in the future.

Although you have already increased your intake in the past, you are not quite eating the recommended level of at least five servings of fruit and vegetables a day. We would like you to think about increasing the amount of fruit and vegetables you eat again.

(maintainers and precontemplators)
You said that you are not planning to increase the amount of fruit you eat. It is important that you reconsider this. You said that you have already increased the amount of vegetables you eat to at least 2 servings a day. Well done, keep it up. It is important to keep on eating at least 5 servings of fruit and vegetables daily in the future.

(decision making and maintainers)
This means that most of the time, you are not quite eating the recommended amount of fruit and vegetables. You said you are planning to increase the amount of fruit you eat in the next month. This is a very good idea. You also said you have already increased the amount of vegetables you eat to at least 2 servings a day. Well done keep it up. It is important to keep on eating at least 5 servings of fruit and vegetables daily in the future.

(decision makers and precontemplators)
This means that most of the time, you are not quite eating the recommended amount of fruit and vegetables. You said you are planning to increase the amount of fruit you eat in the next month. This is a very good idea. You also said you are not planning to increase the amount of vegetables you eat. It is important that you reconsider this.

(maintainers and precontemplators)
You said that you are not planning to increase the amount of vegetables you eat. It is important that you reconsider this. You said that you have already increased the amount of fruit you eat to at least 2 servings a day. Well done, keep it up. It is important to keep on eating at least 5 servings of fruit and vegetables daily in the future.

(decision making and maintainers)
This means that most of the time, you are not quite eating the recommended amount of fruit and vegetables. You said you are planning to increase the amount of vegetables

you eat in the next month. This is a very good idea. You also said you have already increased the amount of fruit you eat to at least 2 servings a day. Well done keep it up. It is important to keep on eating at least 5 servings of fruit and vegetables daily in the future.

(decision makers and precontemplators)
This means that most of the time, you are not quite eating the recommended amount of fruit and vegetables. You said you are planning to increase the amount of vegetables you eat in the next month. This is a very good idea. You also said you are not planning to increase the amount of fruit you eat. It is important that you reconsider this.

Recommended servings statements
In fact the new recommendation is that people should eat at least 5 servings of fruit and vegetables a day.
The recommendation today is that everyone should eat at least 5 servings of fruit and vegetables a day.
This is correct. The new recommendation is that people should eat at least 5 servings of fruit and vegetables a day.
You are right. The recommendation today is that everyone should eat at least 5 servings of fruit and vegetables a day.

Increases in intake statements
We recommend you increase the amount of fruit you eat by at least X servings a day and the amount of vegetables you eat by at least X serving a day.

We recommend you increase the amount of fruit you eat by at least X servings a day and carry on eating at least as much vegetables as you are eating at the moment.

We recommend you increase the amount of vegetables you eat by at least X servings a day and carry on eating at least as much fruit as you are eating at the moment.

We recommend that you carry on eating at least as much fruit and vegetables as you are eating at the moment.

Disease statements
You correctly said eating too little fruit and vegetables is related to heart disease but did you know that it is related to many cancers.

You correctly said eating too little fruit and vegetables is related to cancer but did you know that it is related to heart disease.

You correctly said eating too little fruit and vegetables is related to cancer and heart disease.

You did not know that eating too little fruit and vegetables is related to many cancers and heart disease.

Vitamin statements
You thought that fruit and vegetables contain high levels of vitamins. You are right.

You thought that fruit and vegetables contain medium levels of vitamins.

You thought that fruit and vegetables contain low levels of vitamins.

You thought that fruit contain high levels and vegetables contain medium levels of vitamins.

You thought that fruit contain high levels and vegetables contain low levels of vitamins.

You thought that vegetables contain high levels and fruit contain medium levels of vitamins.

You thought that vegetables contain high levels and fruit contain low levels of vitamins.

You thought that fruit contain medium levels and vegetables contain low levels of vitamins.

You thought that vegetables contain medium levels and fruit contain low levels of vitamins.

Fibre statements
You thought that fruit and vegetables contain high levels of fibre. You are right.

You thought that fruit and vegetables contain medium levels of fibre.

You thought that fruit and vegetables contain low levels of fibre.

You thought that fruit contain high levels and vegetables contain medium levels of fibre.

You thought that fruit contain high levels and vegetables contain low levels of fibre.

You thought that vegetables contain high levels and fruit contain medium levels of fibre.

You thought that vegetables contain high levels and fruit contain low levels of fibre.

You thought that fruit contain medium levels and vegetables contain low levels of fibre.

You thought that vegetables contain medium levels and fruit contain low levels of fibre.

You thought that fruit and vegetables contain low levels of calories. You are right.

You thought that fruit and vegetables contain medium levels of calories.

You thought that fruit and vegetables contain high levels of calories.

You thought that fruit contain low levels and vegetables contain medium levels of calories.

You thought that fruit contain low levels and vegetables contain high levels of calories.

You thought that vegetables contain low levels and fruit contain medium levels of calories.

You thought that vegetables contain low levels and fruit contain high levels of calories.

You thought that fruit contain medium levels and vegetables contain high levels of calories.

You thought that vegetables contain medium levels and fruit contain high levels of calories.

Antioxidant statements
You said you have not heard of antioxidants.

You said you have heard of antioxidants.

Processes of change statements
You say you aren't thinking about eating more fruit and vegetables at the moment, even though you aren't eating enough for a healthy diet. Why don't you spends sometime thinking about how much fruit and vegetables you are eating right now.

Remember that it is important to eat at least 5 servings of fruit and vegetables a day. This means having a variety of different fruits and vegetables to give you the nutrients you need.

Why don't you think about the extra health benefits you will get from eating more fruit and vegetables. Eating lots of fruit and vegetables is especially important for your long-term health.

We feel that if you think about the reasons why you should be eating more fruit and vegetables, it will be a lot easier to start doing so. We strongly recommend this. Try some of the ideas below. Good luck!

You know you should eat more fruit and vegetables. It is just a question of how to get started.

You may think that eating more fruit and vegetables will mean more cost and more preparation. However if you plan ahead, fruit and vegetables can be a cheap addition to your diet and only take a few minutes to prepare.

Remember the health benefits! Eating more fruit and vegetables is especially important for reducing your risk of developing many types of cancer and heart disease, as well as helping your body work better.

Think about ways you could add more fruit and vegetables to your diet. Why not try the ideas below. Good luck!

You say that you are already eating more fruit and vegetables. However you need to keep this up, so get your friends and family to do the same.

There are various ways to eat more fruit and vegetables in your diet. It is important to plan ahead by keeping some frozen or tinned fruit and vegetables in the house so you don't run out.

Be confident and think about other ways you can add fruit and vegetables to what you eat. Why not have fruit instead of snacks or an extra serving of vegetables with your meal to fill you up.

Why not try some of the ideas below to help you keep it up. Good luck!

Macro 42 (decision makers and maintainers)

You know you should eat more fruit ?. It is just a question of how to get started. Think about ways you could add more fruit to your diet. You could have fruit instead of snacks. You say that you are already eating more vegetables. Get your friends and family to do the same, and that will help you keep it up. Also plan ahead by keeping some frozen or tinned fruit and vegetables in the house so you don't run out. Good luck!

Macro 43 (precontemplators and maintainers)

It may help if you spend a little time thinking about the amount of vegetables you are eating at the moment ?. You could consider the health benefits that you would get from eating more vegetables. We would strongly recommend this. You say that you are already eating more fruit. Get your friends and family to do the same, and that will help you to keep it up. Also plan ahead by keeping some frozen or tinned fruit and vegetables in the house so you don't run out. Good luck!

Macro 44

You know you should eat more fruit. It is just a question of how to get started. Think about ways you could add more fruit to your diet. You could have fruit instead of snacks. Also it may help if you spend a little time thinking about the amount of vegetables you are eating at the moment. You could consider the health benefits that you would get from eating more and vegetables. We would strongly recommend this. Good luck

Attitude statements

"fruit is difficult to prepare".

Actually fruit can be very easy to prepare. Most fruits only need to be washed or peeled before eaten. Fruits such as apples, rhubarb and blackberries are good for making purees and crumbles. A fruit salad can be prepared quickly by chopping up raw fruit, and you can vary the ingredients by adding some tinned fruit.

"fruit doesn't keep very well".

We think you'll find fruit keeps better when stored properly. Don't leave fruit in direct sunlight. Keep it in a cool spot or even in the fridge. Also remember not to pile fruits on top of one another. This will avoid them bruising or going bad. Tinned and dried fruit also count as part of your daily servings. After opening tins of fruit, remember to keep the fruit in the fridge.

"fruit is expensive".

Fruit can work out cheaper than snacking alternatives. Look out for special offers at your local shops and supermarkets. Tinned fruit in natural juice, a glass of pure fruit juice or dried fruit also count as part of your daily servings.

"good fruit can't be bought at my local shops"

Remember fruit does not need to be fresh every time. Tinned and dried fruit count as part of your daily servings. Take time to stock up with fruit if you are near a supermarket or greengrocers shop.

"fruit is not easy to prepare"
Fruit such as bananas, apples or grapes are easy to eat and prepare. You can eat fruit instead of sugary and fatty snacks such as biscuits and chocolate.

"fruit doesn't taste delicious".
There are lots of different kinds of fruit available at your local shops and supermarkets. Try something new if you don't like any of the more common ones. Remember you can also eat tinned fruit with natural juice as part of your intake.

"fruit is not very filling".
Fruit are an important part of what you eat. Ensure that you eat fruit with your meals and for snacks. Eating bananas and some dried fruit help to fill you up. It is important to eat fruit instead of higher fat or sugary foods when you are hungry.

"fruit is not good for weight control".
Fruit is low in calories and therefore good to eat if you are trying to control your weight. Therefore they should be an important part of what you eat. Remember to eat fruit instead of other foods such as snacks and cakes which are higher in fat and sugar. Fruit is also packed with vitamins and minerals which are good for your body.

"fruit is difficult to carry around".
Fruit can be quite heavy if you buy a lot of it at the same time. Instead pick up small amounts as you pass the shops. This way they will last for longer too. If carrying fruit around protect it by packing with something soft to avoid bruising. Remember that dried fruit also counts as part of your servings and is very easy to carry around.

"vegetables don't keep very well".
We think you'll find vegetables are easy to keep when stored properly. Fresh vegetables should be stored away from direct sunlight in a cool, dry place. Salad items can be stored in the fridge or covered in a cool place. Frozen and tinned vegetables also count as part of your daily servings. After opening tins of vegetables, remember to keep the vegetables in the fridge.

"vegetables are difficult to cook"
Some vegetables are easy to cook. It is true that most vegetables need to be washed or peeled, but then they can be easily boiled, steamed, or roasted. Remember frying or roasting vegetables increases the fat, so only do so occasionally. Use vegetables in soups or stews to add flavour. Many vegetables like carrots and peppers taste good when eaten raw. Tinned or frozen vegetables are a good alternative if you are in a hurry.

"vegetables are expensive".
Vegetables can work out cheaper than you think. They are a good way of filling up and adding variety to your meals. Look out for special and seasonal offers at your local shops and supermarkets. Remember that tinned and frozen vegetables also count as part of your daily servings.

" good vegetables can't be bought at your local shops".

Vegetables do not need to be fresh every time. Frozen and tinned vegetables also count as part of your daily servings. Take time to stock up on vegetables if you are near a supermarket or greengrocers.

"vegetables don't make a convenient snack".
You can make a quick and easy snack by chopping up raw vegetables. Next time you are about to eat fatty snacks like crisps or crackers, consider eating a raw tomato or carrot instead.

"vegetables don't taste delicious".
There are lots of different vegetables available at your local shops and supermarkets. Try something new if you don't like any of the more common ones. You can mix them with other things to make them taste different. You could always try adding a stock cube or some herbs as you cook them.

"vegetables are not very filling".
Vegetables are an important part of what you eat. Try a combination of vegetables to help fill you up. Vegetables such as corn help to fill you up. Why not combine them with other filling foods such as potatoes, rice or pasta. Also remember beans and pulses count as part of your servings

"vegetables are not good for weight control".
Vegetables are low in calories and therefore good to eat if you are trying to control your weight. Replace other higher calories food with more vegetables. For example use a tomato pasta sauce instead of a cream one.

"vegetables are difficult to carry around".
If you try to carry large quantities of vegetables at the same time they can be quite heavy. Therefore pick up small amounts when you pass the shops next time. Remember that frozen vegetables also count and are easier to carry if you are travelling short journeys.

"vegetables take a long time to prepare".

You said you thought *"fruit is not very filling and doesn't keep very well ".*
Fruit are an important part of what you eat. Ensure that you eat fruit with your meals and for snacks. Eating bananas and some dried fruit help to fill you up. It is important to eat fruit instead of higher fat or sugary foods when you are hungry. We think you'll find fruit keeps better when stored properly. Don't leave fruit in direct sunlight. Keep it in a cool spot or even in the fridge. Also remember not to pile fruits on top of one another. This will avoid them bruising or going bad. Tinned fruit and dried fruit also count as part of your daily servings. After opening tins of fruit, remember to keep the fruit in the fridge.
You were very positive about fruit . We agree with you. Fruit should be an important part of what you eat. Remember that frozen, tinned and dried fruit also count as part of your daily servings.

You were very positive about vegetables . We agree with you. Vegetables should be an important part of what you eat. Remember that frozen and tinned vegetables also count as part of your daily servings.

You were very positive about fruit and vegetables . We agree with you. Fruit and vegetables should be an important part of what you eat. Remember that frozen and tinned fruit and vegetables also count as part of your daily servings.

"fruit is expensive and doesn't keep very well".
Fruit can work out cheaper than some snack alternatives. Look out for special offers at your local shops and supermarkets. Tinned fruit in natural juice, a glass of pure fruit juice or dried fruit also count as part of your servings. Also we think you'll find fruit keeps better when stored properly. Don't leave fruit in direct sunlight. Keep it in a cool spot or even in the fridge. Remember not to pile fruits on top of one another, this will avoid them bruising. After opening tins of fruit, remember to keep them in the fridge.

"fruit doesn't keep very well and good fruit can't be bought at your local shops".
We think you'll find fruit keeps better when stored properly. Don't leave fruit in direct sunlight. Keep it in a cool spot or even in the fridge. Also remember not to pile fruits on top of one another, this will avoid them bruising. Tinned and dried fruit also count as part of your daily servings. After opening tins of fruit, remember to keep them in the fridge. Also remember fruit does not need to be fresh every time. Take time to stock up with tinned or dried fruit if you are near a supermarket or greengrocers shop.

"good fruit can't be bought at your local shops and fruit is expensive".
Remember fruit does not need to be fresh every time. Tinned and dried fruit count as part of your daily servings. Take time to stock up with fruit if you are near a supermarket or greengrocers shop. Also fruit can work out cheaper than snacking alternatives or desserts. Look out for special offers at your local shops and supermarket. Remember that a glass of pure fruit juice also counts as part of your daily servings.

"vegetables don't make a convenient snack and don't keep very well".
You can make a quick and easy snack by chopping raw vegetables. Next time you are about to eat fatty snacks like crisps or crackers, consider eating a tomato or carrot instead. Also we think you'll find vegetables are easy to keep when stored properly. Fresh vegetables should be stored away from direct sunlight in a cool, dry place. Salad items can be stored in the fridge or covered in a cool place. Frozen and tinned vegetables also count as part of your daily servings. After opening tins of vegetables, remember to keep them in the fridge.

"vegetables are expensive and don't keep very well". Vegetables can work out cheaper than you think. They are a good way of filling up and adding variety to your meals. Look out for special and seasonal offers at you local shops and supermarkets. Also we think you'll find vegetables are easy to keep when stored properly. Fresh vegetables should be stored away from direct sunlight in a cool, dry place. Salad items can be stored in the fridge or covered in a cool place. Frozen and tinned vegetables also count as part of your daily servings. After opening tins of vegetables, remember to keep them in the fridge.

"vegetables don't keep very well and good vegetables can't be bought locally ".
We think you'll find vegetables are easy to keep when stored properly. Fresh vegetables should be stored away from direct sunlight in a cool, dry place. Salad items can be stored in the fridge or covered in a cool place. Frozen and tinned vegetables also count as part of your daily servings. After opening tins of vegetables, remember to keep them in the fridge. Vegetables do not need to be fresh every time. Take time to stock up on vegetables if you are near a supermarket or greengrocers.

"vegetables are expensive and don't make a convenient snack". Vegetables can work out cheaper than you think. They are a good way of filling up and adding variety to your meals. Look out for special seasonal offers at your local shops and supermarkets. You can make a quick and easy snack by chopping raw vegetables. Next time you are about to eat fatty snacks like crisps or crackers, consider eating a tomato or carrot instead.

"vegetables don't taste delicious and don't make a convenient snack".
There are lots of different vegetables available at your local shops and supermarkets. Try something new, if you don't like any of the more common ones. You could always try adding a stock cube or some herbs as you cook them to make them taste different. Also you can make a quick and easy snack by chopping raw vegetables. Next time you are about to eat fatty snacks like crisps or crackers, consider eating a tomato or carrot instead.

"vegetables do not make a convenient snack and good vegetables can't be bought in your local shops".
You can make a quick and easy snack by chopping raw vegetables. Next time you are about to eat fatty snacks like crisps or crackers, consider eating a tomato or carrot instead. Vegetables do not need to be fresh every time. Frozen and tinned vegetables also count as part of your daily servings. Take time to stock up on vegetables if you are near a supermarket or greengrocers.

X: number
?: name

We have now analysed your results from the eating questionnaire you completed at the dental clinic «Title» «Last_name». Based on your replies, we have designed this leaflet especially for you. This leaflet tells you about the benefits of eating more fruit and vegetables. It also gives you some suggestions on how you can do this.

How much fruit and vegetables do you eat now «Title» «Last_name»?

Your results show that you eat

«servings_of_fruit»	**«servings_of_veg»**

«stage» We hope that this leaflet will give you some ideas about why fruit and vegetables are important.

We recommend 5 or more servings of fruit and vegetables a day

You said you thought health experts recommend «recoserv» servings of fruit and vegetables a day. «recommend» The recommendation today it that everyone should eat at least 5 servings of fruit and vegetables a day.

We recommend you «eat more».

Why should you eat more fruit and vegetables «Title» «Last_name»?

«diseases» By eating lots of fruit and vegetables you can reduce the risk of you getting many cancers or heart disease later on.

You thought that «vitamins»

Fruit and vegetables are full of Vitamins A, B, C and E as well as other essential nutrients.

- Vitamin A and B are good for growth and repair of nerves and tissue in the body.
- Vitamin C helps fight infections.
- Vitamin E is good for circulation.

You thought that «fibre»

Fibre is found in most fruit and vegetables. It is good for keeping the bowel healthy and reducing blood cholesterol levels.

You thought that «calories»

Fruit and vegetables are low in calories which means they are good for keeping you at a healthy weight or as part of a weight control diet.

You said that you have «antioxidants» heard of antioxidants.

Fruit and vegetables also contain antioxidants. These help protect your body cells from damage by attacking 'free radicals' that can harm cells. Free radicals are thought to be linked to the development of both cancer and heart disease.

How can you eat more fruit and vegetables «Title» «Last name»?

«stage»

fruit

- Eat fruit instead of sugary snacks or desserts.
- Always keep the fruit bowl stocked up with some fruit.
- Keep plenty of tinned fruit at home.

vegetables

- Have an extra serving of vegetables with your main meal.
- Have some salad with your lunch or put extra salad in your sandwiches.
- Use vegetables to make stews, soups or stir-frys.

We have now analysed your results from the eating questionnaire you completed at the dental clinic Mr Blair. Based on your replies, we have designed this leaflet especially for you. This leaflet tells you about the benefits of eating more fruit and vegetables. It also gives you some suggestions on how you can do this.

How much fruit and vegetables do you eat now Mr Blair?

Your results show that <u>you</u> eat

3-4 servings of fruit a week	**5-6 servings of vegetables a week**

It is important that you think about eating more fruit and vegetables if you are not doing so already. At the moment you are not eating the recommended levels of fruit and vegetables. We hope that this leaflet will give you some ideas about why fruit and vegetables are important.

We recommend 5 or more servings of fruit and vegetables a day

You said you thought health experts recommend 6 servings of fruit and vegetables a day. You are correct. The recommendation today it that everyone should eat at least 5 servings of fruit and vegetables a day.

We recommend you increase your fruit intake by at least 3 servings a day and increase your vegetable intake by at least 2 servings a day.

Why should you eat more fruit and vegetables Mr Blair?

You correctly said that eating too little fruit and vegetables is related to heart disease but did you know that it is related to many cancers. By eating lots of fruit and vegetables you can reduce the risk of you getting many cancers or heart disease later on.

You thought that fruit and vegetables contain high levels of vitamins. You are right.

Fruit and vegetables are full of Vitamins A, B, C and E as well as other essential nutrients.

- Vitamin A and B are good for growth and repair of nerves and tissue in the body.
- Vitamin C helps fight infections.
- Vitamin E is good for circulation.

You thought that fruit contain medium levels and vegetables contain high levels of fibre.

Fibre is found in most fruit and vegetables. It is good for keeping the bowel healthy and reducing blood cholesterol levels.

You thought that fruit and vegetables contain low levels of calories. You are right.

Fruit and vegetables are low in calories which means they are good for keeping you at a healthy weight or as part of a weight control diet.

You said that you have heard of antioxidants.

Fruit and vegetables also contain antioxidants. These help protect your body cells from damage by attacking 'free radicals' that can harm cells. Free radicals are thought to be linked to the development of both cancer and heart disease.

How can you eat more fruit and vegetables Mr Blair?

You say you aren't thinking about eating more fruit and vegetables at the moment, even though you aren't eating enough for a healthy diet. Why don't you spend some thinking about how much fruit and vegetables you are eating right now.

Remember that it is important to eat at least 5 servings of fruit and vegetables a day. means having a variety of different fruits vegetables to give you the nutrients you need.

Why don't you think about the extra health benefits you will get from eating more fruit vegetables. Eating lots of fruit and vegetables is especially important for your long-term health.

We feel that if you think about the reasons why you should be eating more fruit and vegetables, it will be a lot easier to start doing so. We strongly recommend this. Try some of the ideas below. Good luck!

fruit

- Eat fruit instead of sugary snacks or desserts.
- Always keep the fruit bowl stocked up with some fruit.
- Keep plenty of tinned fruit at home.

vegetables

- Have an extra serving of vegetables with your main meal.
- Have some salad with your lunch or put extra salad in your sandwiches.
- Use vegetables to make stews, soups or stir-frys.

APPENDIX 16: ***Tailored intervention letter***

1 March 1999

Dear «title» «last_name»,

Last year, while you were at «Site» you filled in a questionnaire about fruit and vegetables. You said you were interested in receiving information about adopting a healthy diet. We are now pleased to send you a leaflet about fruit and vegetables.

This leaflet has been personalised for you based on the answers you gave in the questionnaire. It tells you how much fruit and vegetables you should be eating, the benefits of eating more fruit and vegetables, and advice on how to go about eating more fruit and vegetables. We hope that you will find this leaflet informative and helpful.

In the next month, we would like to contact you again to ask you what you thought about the leaflet. This will involve us sending you a short questionnaire to fill in.

We are very grateful for your assistance in this study. If you have any questions you would like to ask, please call me on 0171 209 6634.

Thank you very much for reading the leaflet.

Yours sincerely

Anna H. Baker

Anna H Baker
Research Psychologist

This leaflet tells you about how much fruit and vegetables people should eat, the benefits of eating more fruit and vegetables and how to look after fruit and vegetables.

How much fruit and vegetables should people eat?

In the United Kingdom the average intake of fruit and vegetables is about 3 servings a day. Health experts recommend that people should be eating at least 5 servings a day of fruit and vegetables. Not a lot of people know this. This means having a mixture of both fruit and vegetables daily.

We recommend 5 or more servings of fruit and vegetables a day

Most people in Britain don't eat enough fruit or vegetables. Ideally people should eat at least 3 servings of vegetables and at least 2 servings of fruit daily.

A serving size will be described later on.

Why should people eat more fruit and vegetables?

It has been found that fruit and vegetables are protective against diseases in the long-term. Eating lots of fruit and vegetables helps to decrease the risk of getting cancer or heart disease.

Fruit and vegetables are very good for you. They contain a variety of minerals, vitamins and nutrients.

Fruit and vegetables are full of Vitamins A, B, C and E as well as other essential nutrients.

- Vitamins A and B are good for growth and repair of nerves and tissue in the body.
- Vitamin C helps fight infections.
- Vitamin E is good for circulation.
- Fibre is an important nutrient which is good for keeping the bowel healthy and reducing blood cholesterol levels.

Fruit and vegetables are low in calories which means they are good for keeping a healthy weight or as part of a weight control diet.

Fruit and vegetables also contain antioxidants. These help protect your body cells from damage by attacking 'free radicals' that can harm cells. Free radicals are thought to be linked to the development of both cancer and heart disease.

How to eat more fruit and vegetables.

fruit

- Eat fruit instead of sugary snacks or desserts.
- Always keep the fruit bowl stocked up with some fruit.
- Keep plenty of tinned fruit at home.

vegetables

- Have an extra serving of vegetables with your main meal.
- Have some salad with your lunch or put extra salad in your sandwiches.
- Use vegetables to make stews, soups or stir-frys.

Fruit and vegetables are a healthy addition to anybody's diet. It is important to eat a variety of different kinds to give the body the different nutrients it needs. Fruit and vegetables are good for the body and improve the overall quality of people's diet.

APPENDIX 18: *General intervention letter*

1 March 1999

Dear Madam/Sir,

Last year, while you were at the dentist you filled in a questionnaire about fruit and vegetables. You said you were interested in receiving more information about adopting a healthy diet. We are now pleased to send you a leaflet about fruit and vegetables.

This leaflet tells you how much fruit and vegetables you should be eating and the benefits of eating more fruit and vegetables. It also gives you advice on how to go about eating more fruit and vegetables. We hope that you will find this leaflet informative and helpful.

In the next month, we would like to contact you again to ask you what you thought about the leaflet. This will involve us sending you a short questionnaire to fill in.

We are very grateful for your assistance in this study. If you have any questions you would like to ask, please call me on 0171 209 6634.

Thank you very much for reading the leaflet.

Yours faithfully

Anna H. Baker

Anna H Baker
Research Psychologist

FRUIT AND VEGETABLE QUESTIONNAIRE

Answer each question by colouring in the circle **completely** (e.g. ●)

1. Recently how many servings of <u>fruit</u> have you been eating? *A serving is the equivalent of an apple, orange, banana or a small bowlful of raspberries, strawberries etc.* *Please mark the appropriate box.*

0-2 a week	3-4 a week	5-6 a week	1 a day	2 a day	3 a day	4 a day	5+ a day
O	O	O	O	O	O	O	O

2. Recently how many servings of <u>vegetables</u> have you been eating? *A serving is the equivalent of a handful of carrots, a side serving of peas or a small side salad*. **Do not include potatoes.** *Please mark the appropriate box.*

0-2 a week	3-4 a week	5-6 a week	1 a day	2 a day	3 a day	4 a day	5+ a day
O	O	O	O	O	O	O	O

3. How many glasses of fruit juice do you drink a week? *If none, please leave blank* [ ][ ]

4. Do you think the amount of <u>fruit</u> you eat now is?
O Not enough O About right O Too much

5. Do you think the amount of <u>vegetables</u> you eat now is?
O Not enough O About right O Too much

6. Are you seriously thinking about increasing the amount of <u>fruit</u> you eat sometime in the next 6 months?
O No
O Yes ⇨ **If yes, are you plannning to make this increase in the next month?** O Yes O No

7. Have you changed your eating habits in the past 6 months to increase the amount of <u>fruit</u> in your diet? O No O Yes

8. Are you seriously thinking about increasing the amount of <u>vegetables</u> you eat sometime in the next 6 months? O No
O Yes ⇨ **If yes, are you plannning to make this increase in the next month?** O Yes O No

9. Have you changed your eating habits in the past 6 months to increase the amount of <u>vegetables</u> in your diet? O No O Yes

10. Do you know of any major health problems or diseases that are related to eating too little <u>fruit and vegetables</u>? O Yes O No

10a. If yes, which disease/s do you think are related to eating too little <u>fruit and vegetables</u>?

Please put one letter in each box and leave a space between each word

11. How many servings of <u>fruit and vegetables</u> (combined) a day do health experts recommend?

[ ] *Guess if you do not know*

12. Have you heard of antioxidants? O Yes O No

205

O T O G O C **Please turn over the page** ⇨

APPENDIX 20: ***Tailored follow-up letter***

12 April 1999

Dear «Title» «Last_name»,

You were recently sent a personalised leaflet about eating fruit and vegetables. We are now sending everybody a short questionnaire about the leaflet to complete. If by any chance you did not receive the leaflet, then please call me and I will send one to you as soon as possible.

Please fill it in as honestly as possible, answering every question. Your answers are very important in helping us find out more about what influences what people eat. If there are any comments you wish to add, then please to do so at the end. Please return the completed questionnaire to us in the enclosed envelope within the next 7 days. Note no stamp is needed.

To thank you for taking part in this study, we are entering everybody who returns the questionnaire in to a competition to win Marks and Spencer's vouchers. There will be a 1st prize of £50, 2nd of £20 and 3rd prize of £10 given out. The winners will be contacted shortly after the draw. We will also be sending out information on adopting healthy diets within the next few weeks.

We are grateful for your help. The information you give us will be very useful in helping us to design leaflets about diet. If you have any questions you would like to ask, please call me on 0171 209 6634.

Yours sincerely

Anna H. Baker

Anna H Baker
Research Psychologist

MARKING INSTRUCTIONS:
Please:

- only use a black pen
- colour in the circle completely
- if you make a mistake, place a cross through the wrong marking (see below)

The right way to mark your answer: ● ○ ○ ○ ○

What to do if you make a mistake: ● ○ ~~●~~ ○ ○

«Number»

APPENDIX 21: ***General follow-up letter***

12 April 1999

Dear <<name>>,

You were recently sent a leaflet about eating fruit and vegetables. We are now sending everybody a short questionnaire about the leaflet to complete. If by any chance you did not receive the leaflet, then please call me and I will send one to you as soon as possible.

Please fill it in as honestly as possible, <u>answering every question</u>. Your answers are very important in helping us find out more about what influences what people eat. If there are any comments you wish to add, then please to do so at the end. Please return the completed questionnaire to us in the enclosed envelope within the next 7 days. <u>Note no stamp is needed.</u>

To thank you for taking part in this study, we are entering everybody who returns the questionnaire in to a competition to win Marks and Spencer's vouchers. There will be a 1st prize of £50, 2nd of £20 and 3rd prize of £10 given out. The winners will be contacted shortly after the draw. We will also be sending out information on adopting healthy diets within the next few weeks.

We are grateful for your help. The information you give us will be very useful in helping us to design leaflets about diet. If you have any questions you would like to ask, please call me on 0171 209 6634.

Yours sincerely

Anna H. Baker

Anna H Baker

<u>**Research Psychologist**</u>

MARKING INSTRUCTIONS:

Please:

- only use a black pen
- colour in the circle completely
- if you make a mistake, place a cross through the wrong marking (see below)

The right way to mark your answer: ● ○ ○ ○ ○

What to do if you make a mistake: ● ○ ~~●~~ ○ ○

APPENDIX 22: ***Control follow-up letter***

12 April 1999

Dear «Title» «Last_name»,

Last year, while you were at the dentist clinic, you filled in some questions about fruit and vegetables. You said that you would like to receive more information about adopting a healthy diet. To enable us to do this we are asking everybody to fill in another short questionnaire about fruit and vegetables.

Please fill it in as honestly as possible, <u>answering every question</u>. Your answers are very important in helping us find out more about what influences what people eat. Please return the completed questionnaire to us in the enclosed envelope within the next 7 days. <u>Note no stamp is needed.</u>

To thank you for taking part in this study, we are entering everybody who returns the questionnaire in to a competition to win Marks and Spencer's vouchers. There will be a 1^{st} prize of £50, 2^{nd} of £20 and 3^{rd} prize of £10 given out. The winners will be contacted shortly after the draw. We will also be sending out information on adopting healthy diets within the next few weeks.

We are very grateful for your help in this study. The information you give us is useful in finding out more about people's fruit and vegetable intake. If you have any questions you would like to ask, please call me on 0171 209 6634.

Yours sincerely

Anna H. Baker

Anna H Baker
<u>Research Psychologist.</u>

MARKING INSTRUCTIONS:
Please:

- only use a black pen
- colour in the circle completely
- if you make a mistake, place a cross through the wrong marking (see below)

The right way to mark your answer: ● ○ ○ ○ ○

What to do if you make a mistake: ● ○ ~~●~~ ○ ○

«Number»

APPENDIX 25: *Reminder letter for tailored group*

11 May 1999

Dear «Title» «Last_name»,

Several weeks ago you were sent a short questionnaire to complete about a personalised diet leaflet mailed to you a couple of months ago. Unfortunately we have not yet received your questionnaire back and therefore we are mailing you another one to complete. If by any chance you have already completed and mailed the questionnaire to us, we apologise for any inconvenience.

Please fill it in as honestly as possible, <u>answering every question</u>. Your answers are very important in helping us find out more about what influences what people eat. If there are any comments you wish to add, then please to do so at the end. Please return the completed questionnaire to us in the enclosed envelope within the next 7 days. <u>Note no stamp is needed.</u>

To thank you for taking part in this study, we are entering everybody who returns the questionnaire in to a competition to win Marks and Spencer's vouchers. There will be a 1st prize of £50, 2nd of £20 and 3rd prize of £10 given out. The winners will be contacted shortly after the draw. We will also be sending out information on adopting healthy diets within the next few weeks.

We are grateful for your help. The information you give us will be very useful in helping us to design leaflets better leaflet about diet, for people in the future. If you have any questions you would like to ask, please call me on 0171 209 6634.

Yours sincerely

Anna H. Baker

Anna H Baker
<u>Research Psychologist</u>

MARKING INSTRUCTIONS:
Please:

- colour in the circle completely
- if you make a mistake, place a cross through the wrong marking (see below)

The right way to mark your answer: ● ○ ○ ○ ○

What to do if you make a mistake: ● ○ ✗ ○ ○ «Number»

APPENDIX 24: ***General intervention group reminder letter***

11 May 1999

Dear «Title» «Last_name»,

Several weeks ago you were sent a short questionnaire to complete about a diet leaflet mailed to you a couple of months ago. Unfortunately we have not yet received your questionnaire back and therefore we are mailing you another one to complete. If by any chance you have already completed and mailed the questionnaire to us, we apologise for any inconvenience.

Please fill it in as honestly as possible, <u>answering every question</u>. Your answers are very important in helping us find out more about what influences what people eat. If there are any comments you wish to add, then please to do so at the end. Please return the completed questionnaire to us in the enclosed envelope within the next 7 days. <u>Note no stamp is needed.</u>

To thank you for taking part in this study, we are entering everybody who returns the questionnaire in to a competition to win Marks and Spencer's vouchers. There will be a 1st prize of £50, 2nd of £20 and 3rd prize of £10 given out. The winners will be contacted shortly after the draw. We will also be sending out information on adopting healthy diets within the next few weeks.

We are grateful for your help. The information you give us will be very useful in helping us to design leaflets better leaflet about diet, for people in the future. If you have any questions you would like to ask, please call me on 0171 209 6634.

Yours sincerely

Anna H. Baker

Anna H Baker
<u>Research Psychologist</u>

MARKING INSTRUCTIONS:
Please:

- colour in the circle completely
- if you make a mistake, place a cross through the wrong marking (see below)

The right way to mark your answer: ● ○ ○ ○ ○

What to do if you make a mistake: ● ○ ~~●~~ ○ ○

«Number»

APPENDIX 25: *Reminder letter for control group*

11 May 1999

Dear «Title» «Last_name»,

Several weeks ago you were sent a short questionnaire to complete about a fruit and vegetables, so that we could send you a leaflet about healthy eating. Unfortunately we have not yet received your questionnaire back and therefore we are mailing you another one to complete. If by any chance you have already completed and mailed the questionnaire to us, we apologise for any inconvenience.

Please fill it in as honestly as possible, <u>answering every question</u>. Your answers are very important in helping us find out more about what influences what people eat. If there are any comments you wish to add, then please to do so at the end. Please return the completed questionnaire to us in the enclosed envelope within the next 7 days. <u>Note no stamp is needed.</u>

To thank you for taking part in this study, we are entering everybody who returns the questionnaire in to a competition to win Marks and Spencer's vouchers. There will be a 1st prize of £50, 2nd of £20 and 3rd prize of £10 given out. The winners will be contacted shortly after the draw. We will also be sending out information on adopting healthy diets within the next few weeks.

We are grateful for your help. The information you give us will be very useful in helping us to design leaflets better leaflet about diet, for people in the future. If you have any questions you would like to ask, please call me on 0171 209 6634.

Yours sincerely

Anna H. Baker

Anna H Baker
<u>Research Psychologist</u>

MARKING INSTRUCTIONS:
Please:

- colour in the circle completely
- if you make a mistake, place a cross through the wrong marking (see below)

The right way to mark your answer: ● ○ ○ ○ ○

What to do if you make a mistake: ● ○ ⊗ ○ ○

«Number»

APPENDIX 26: ***Accompanying control intervention letter***

Health Behaviour Unit
Department of Epidemiology and Public Health
University College London
1-19 Torrington Place
London
WC1E 6BT

Dear Madam/Sir,

Some time ago you requested information about fruit and vegetables. We are now ready to send out a leaflet for you to read. This is part of a large study conducted at University College London. We are extremely grateful for all your help in our work.

Yours faithfully,

Anna H Baker
Research Psychologist